

Revised July 2020

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# **Savannah District Design Manual for Military Construction**

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**Volume II of II: Technical  
and Value Engineering Requirements  
For Request for Proposal and Full  
Design Preparation**



**US Army Corps of Engineers  
Savannah District  
P.O. Box 889  
Savannah, Georgia 31402-0889**

**VOLUME II**

**TECHNICAL  
AND  
VALUE ENGINEERING  
REQUIREMENTS FOR REQUEST FOR  
PROPOSAL AND FULL DESIGN  
PREPARATION**

**ENGINEERING DIVISION**

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1.1 **GENERAL.** The Savannah District area of responsibility for military design is Army installations located in Georgia, Fort Jackson, SC, Fort Bragg, NC and Pope Army Airfield. The Savannah District also executes military design and construction for other than Army customers and in locations outside the normal area of responsibility. Within the Savannah District, Design Branch is responsible for the performance of all design and design-related activities in the areas of site development, architectural, electrical, energy, environmental, mechanical, fire protection and structural design. The following chapters are prepared by sections within the Engineering Division of Savannah District Army Corps of Engineers.

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1.2 **COORDINATION.** The AE Contract Management Section of Engineering Division will generally be the single point of contact between the A-E designer and the Corps team members. When direct communication between the A-E designer and Corps design team members is needed, a phone conversation record shall be made and copy furnished to the respective project manager. The A-E shall not be directed to do work outside contract scopes of work.

\*\*\* End of Section \*\*\*

**CHAPTER A-0  
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## **CHAPTER A-0-1**

### **GEOTECHNICAL**

#### **1.1 GENERAL**

The Geotechnical and HTRW Branch is responsible for all related activities in the areas of foundation design, soil mechanics, and geotechnical engineering, including laboratory and field subsurface investigations, as well as executing Engineering Division work related to hazardous, toxic and radioactive waste (HTRW). The Branch consists of three Sections; Soils Section (CESAS-EN-GS), Geology/Hydrogeology and HTRW Design Section (CESAS-EN-GG), and Hazardous, Toxic and Radioactive Waste Section (CESAS-EN-GH). The Geology/Hydrogeology and HTRW Design Section contains a field investigation component, Explorations Unit, with capabilities to perform field and subsurface investigations and sampling. The Soils Section maintains a materials laboratory, Environmental and Materials Unit, with capabilities to perform testing on soils, aggregate, asphalt, concrete, and other miscellaneous materials. Most of the interface between the Branch and the Architect-Engineer (A-E) firms with whom the Savannah District contracts will be with the Soils Section.

#### **1.2 GEOTECHNICAL REPORT**

The Savannah District will generally provide to the A-E all foundation investigations and subsurface data required for the design of the project. This data will set forth site-specific geotechnical technical requirements for the project. It will be the responsibility of the A-E to incorporate these features and to use the furnished parameters and guidance in their design of the structure foundations and site work. The Specific Instructions portion of the contract will inform the A-E if the Government will furnish geotechnical data.

#### **1.3 RESPONSIBILITY OF SECTIONS**

The Soils Section will generally be involved on all projects involving site and/or soils work and interface with the A-E's by preparing and furnishing scopes of work and geotechnical reports and reviewing design submittals. Generally, A-E firms will not have any direct contact with the Geology/Hydrogeology and HTRW Design Section or the Hazardous, Toxic and Radioactive Waste Section; however, in the case of specialized jobs such as those that may involve installation of wells, rock excavation, groundwater monitoring, quarry sources, HTRW, or ordnance/explosives (OE) programs, some interaction should be expected. This contact will be handled in the same manner as any other discipline.

#### **1.4 SUBSURFACE INVESTIGATIONS**

The Geotechnical and HTRW Branch maintains its own in-house subsurface investigation capabilities. It is Branch policy to conduct field and laboratory investigations with Corps of Engineers' forces and provide the data to the A-E for their use.

## 1.5 COORDINATION

While some direct contact between the A-E and Branch Sections are necessary, all communications should flow through the Military Branch Project Manager. In cases where direct contact is needed, conversations or teleconferences shall be documented and provided to the Project Manager to include with project records.

\*\*\* End of Section \*\*\*



**CHAPTER A-0  
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**Revised July 2020**

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## CHAPTER A-0-2

### SOILS

#### 2.1 GENERAL.

2.1.1 *Soils Section.* The Soils Section is responsible for all soil mechanics and geotechnical design of all structures within the Savannah District military boundary. This section provides the Architect-Engineer (A-E) all Geotechnical Reports associated with military design and construction.

2.1.2 *Chapter Description.* This chapter describes requirements pertaining to foundation design and presents data that can be expected in the reports and other items prepared by Soils Section and provided to the A-E. This chapter also lists the specific requirements of submittal stages for geotechnical design features. The Savannah District Corps of Engineers will inform the A-E in the Specific Instructions portion of the contract whether subsurface investigation testing and a foundation design analysis report are required. When required, the Savannah District's Geotechnical and HTRW Branch will accomplish subsurface investigations, field sampling, and laboratory testing, and provide the results to the A-E in report, memo, or email format.

2.1.3 *Geotechnical Report.* A Geotechnical Report will be furnished to the A-E when drilling, testing, and analysis is completed. The Geotechnical Report will be titled appropriately for the information being presented and may be provided in report, memo, or email format. The Geotechnical Report will be based on the data furnished by the A-E on SAS Form Letter 363. Any change in siting or changes to the basic information furnished in the SAS FL 363 shall be provided immediately as these changes will likely affect the analysis. The provided report will typically include the allowable soil bearing value, minimum depth to the base of footing, depth of the groundwater table, special foundation requirements, waterproofing measures, and marked-up specifications. The Geotechnical Report is not limited to the above information and may direct types of foundation to be used at the site, various soil parameters for retaining wall design, critical soil parameters, instrumentation requirements, special construction procedures, required compaction efforts, excavation and drainage requirements, dewatering specifications, borrow area usage, CBR and subgrade modulus values, and any other pertinent foundation and site design information. The analysis may include several alternatives for the solution to a given problem. If this is the case, the A-E then has the latitude of using the solution most compatible with their design. The Geotechnical Report will be furnished the A-E at the time to proceed with final design or as soon thereafter as practicable.

2.1.4 *Field Tests.* Specialty field tests, such as pH measurements, resistivity testing, in-place bearing tests, and percolation/infiltration tests will be included as applicable for use in design by the A-E. Request for soil percolation/infiltration tests should be made by the A-E through the Savannah District Project Manager.

2.1.5 *Preliminary Geotechnical Report.* A preliminary report based on available data in the area can be furnished to the A-E if requested but is subject to change pending results of the subsurface investigation, soils testing, and final analysis.

2.1.6 *Determination of Foundation Investigations.* The Savannah District Geotechnical and HTRW Branch, Soils Section, will determine:

2.1.6.1 The location of borings (including depth of holes) based on the adequacy of the detailed site plan.

2.1.6.2 The location of any required field tests. It should be emphasized that soil borings and testing of soil samples are usually conducted during the concept or preliminary stages and are based on a firm siting of the proposed structures. After completion of the field investigation, the Savannah District will furnish the location of the soil borings which the A-E will locate on an appropriate Plan Sheet(s). The soil boring logs and soil test data will be provided to the A-E for placement on full size drawing sheets and addition to the project drawing set. The A-E should save space on the index for these drawings. Soil Boring Logs and Soil Test Data drawings will be designated "B"-Plates.

## 2.2 APPLICABLE PUBLICATIONS.

UFC 3-220-01	Geotechnical Engineering
UFC 3-320-06A	Concrete Floor Slabs on Grade Subjected to Heavy Loads
IBC (prevailing edition)	International Building Code
UFC 4-151-10	General Criteria for Waterfront Construction

## 2.3 PRECONCEPT SUBMITTAL REQUIREMENTS.

No requirements for 10% design.

## 2.4 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS.

### 2.4.1 *Design Analysis.*

a. Provide a completed SAS Form Letter 363 (Exhibit 2-1) for each structure involved in the contract. (The foundation analysis will be based on information presented in this form along with other data requested on the form.) Provide column and wall loads for the existing building when there is a planned building addition.

b. Incorporate recommendations presented in the Preliminary Report or Final Report if it has been provided at this design stage.

### 2.4.2 *Design Drawings.*

a. Provide a copy of the site plan in electronic format to the Savannah District's Geotechnical and HTRW Branch, Attention: Chief, Soils Section, for the purpose of locating borings. This site plan shall be of sufficient detail to include locations of all proposed structures, roads, parking areas and contours, as well as any existing features such as buildings, fences, roads, parking areas and existing contours. The site plan shall also include the state plane coordinate system for the particular state in which the project is located. Finished floor elevations, of all structures and finished grade elevations shall be indicated. When there is a building addition, the A-E shall provide a plan, which will locate the existing footings and columns. This plan shall also include the depths of existing footings.

b. Locate borings and field test symbols on an applicable plan if locations have been provided by the Savannah District during concept design. A note "See complete logs of borings on plate(s) B- through B- . " will be placed on the same plan. Add the appropriate symbol to legend. The symbols shown on Exhibit 2-2 will be used to identify borings and other exploration techniques on military projects. The soil boring logs as provided by Soils Section will be placed on full size drawing sheets and added to the project drawing set. The A-E should save space on the index for these drawings.

**2.5 PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS.** Comply with comments on the Concept (35%) review.

**2.6 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS.**

a. Comply with comments on the Preliminary (60%) design review.

b. Return specifications required by the Savannah District along with A-E prepared specifications for final review.

c. Include all soil test location, log, and test data drawings and required specifications in the Index for drawings and Table of Contents for specifications.

**2.7 CORRECTED FINAL SUBMITTAL REQUIREMENTS.**

Comply with comments on Final (100%) Design Review and any comments not resolved from previous reviews..

**2.8 TECHNICAL REQUIREMENTS.**

**2.8.1 Deep Foundations.** Recommendations for the type of deep foundation system to be used (piling, caissons, etc.), the size and length of the piling, and the allowable bearing capacity of each pile will be provided. The A-E shall determine the number of piles, actual spacing, and the pile cap design.

**2.8.2 Earth Liners.** Savannah District will provide the A-E with the overall geologic conditions, the in-situ and constructed permeabilities that can be obtained using native materials and stabilizing agents, liner thicknesses, and slope stabilization requirements. The A-E will be required to apply for all necessary permits. As part of the permitting process they will be required to determine the classification of the material to be contained, the permeability necessary to contain the material, and the size and functional configuration of the containment area.

**2.8.3 Cathodic Protection and Grounding Systems.** Savannah District will perform all pH tests, salinity tests, resistivity measurements, etc., required to design corrosion control and grounding systems. The need for these tests shall be identified and furnished by the A-E at the concept design stage. The A-E shall inform the project manager of the required testing methods, testing locations, ground rod lengths etc. These tests will not be performed unless the requirements are identified by the A-E. The raw field data will be provided in report format without interpretation or recommendations. The A-E shall inform the appropriate Savannah District project manager immediately if additional field data is required for the design of the corrosion control and the grounding systems.

2.8.4 *Permanent Water Well Design and Construction.* The A-E will be required to determine the functional location of the well, to verify the liter per minute (or gpm) requirements of the facility, to verify future demands planned for the well, and to determine the pump size, type and setting after receipt of aquifer test data. The A-E shall prepare all drawings and specifications (Section 02671 WATER WELL or 02672 WATER WELLS as appropriate) required to construct the well. In some cases, Savannah District may construct the actual well during the design stage of the project.

2.8.5 *Structures.* Recommendations for the type of foundation system to be used, the allowable bearing capacity, the depth of placement for the footings, and recommendations for floor slab preparation will be provided. The A-E shall size all footings, grade beams, slabs, etc., utilizing the recommendations and restrictions detailed. An Earthwork specification for the structures will also be required by Savannah District. (See Chapter A-2, STRUCTURAL, for further design requirements).

2.8.6 *Pavements.* The allowable design CBR and modulus of subgrade reaction parameters along with required compaction efforts will be provided for pavement subgrades. Guidance will be offered on the types of base course materials available in the area and design strengths. The A-E shall design all pavement types, thicknesses, geometry and locations, and prepare all pavement material specifications. (See Chapter A-1, SITE DEVELOPMENT, for deviations, exceptions, and further design requirements.)

2.8.7 *General Earthwork and Special Features.* Undercutting requirements, fill and backfill placement procedures, types of equipment to use, and earthwork procedures for special features such as retaining walls, embankment construction, earth covering of structures, basements, buried and mounded tanks, utilities, etc. will be provided. It will be the responsibility of the A-E to incorporate these requirements and to use the furnished parameters and guidance in the design.

2.8.8 *Specifications.* The A-E shall use Savannah District guide specification Section 31 00 00 EARTHWORK in the contract specifications. Note that this specification has been modified from the National CEGS guide and must be requested from Savannah District. The A-E will mark up the specification as necessary to meet the project requirements.

## **EXHIBITS**

2-1	SAS FL 363 Foundation Data
2-2	Subsurface Exploration Symbols

## FOUNDATION DATA

Project Title: \_\_\_\_\_

FY-\_\_\_\_\_, P.N.\_\_\_\_\_,

Location: \_\_\_\_\_

A-E Firm: \_\_\_\_\_

A-E Phone No. \_\_\_\_\_

1. The following information is furnished relative to the foundation analysis for the subject project. (A separate CESAS FL 363 should be completed for each structure involved in the project.)

a. Type of structural system: (Brief Statement)

b. General Scope: \_\_\_\_\_ ft. x \_\_\_\_\_ ft \_\_\_\_\_ no stories \_\_\_\_\_.

(Check applicable blocks below)

- |  |   |
|--|---|
| <input type="checkbox"/> Slab-on Grade   | <input type="checkbox"/> Basement Walls         |
| <input type="checkbox"/> Crawl Space   | <input type="checkbox"/> (1) Fixed at 1st Floor |
| <input type="checkbox"/> Retaining Walls   | <input type="checkbox"/> (2) Fixed at Footings  |
| <input type="checkbox"/> Areas Recessed below F.F. (Provide with info for Item 2. below) |   |

c. Type of Foundation: (Check applicable blocks and fill in loads)

- |   |   |
|---|---|
| <input type="checkbox"/> Mat. Foundation  | <input type="checkbox"/> Approx. Max. Load on Mat. Foundation _____ Kips/SF |
| <input type="checkbox"/> Spread Footings  | <input type="checkbox"/> Approx. Max. Col. Load _____ Kips                  |
| <input type="checkbox"/> Wall Footings    | <input type="checkbox"/> Approx. Max. Wall Load _____ Kips/ft.              |
| <input type="checkbox"/> Foundation Walls | <input type="checkbox"/> Grade Beams  |
| <input type="checkbox"/> Rolled Edge Slab | <input type="checkbox"/> Combined Footings (See Item 2. below)              |
| <input type="checkbox"/> Piles            | <input type="checkbox"/> Underpinning (See Item 2. below)                   |

d. Other:

- Pre-Engineered Building      Yes \_\_\_\_\_ No \_\_\_\_\_
- Basement and/or Crawl Space Elevation \_\_\_\_\_ FT
- Finished Floor Elevation \_\_\_\_\_ FT

2. Specific information and/or details relevant to the foundation analysis are provided attached to this form.

3. Included is one reproducible electronic copy of the detailed site plan and a plan showing the location of columns and walls for structures. (If the maximum column load exceeds 100 Kips or the maximum wall load exceeds 3 K/ft., the individual load, dead and live, for each footing shall be provided on the location plan of columns and walls.)

4. Boring locations will be determined by Savannah District personnel.

\_\_\_\_\_  
A-E Representative

\_\_\_\_\_  
Date

**SUBSURFACE EXPLORATION  
SYMBOLS**

SOIL TEST BORING (B- #)



CONE PENETROMETER TEST (CPT- #)



FLAT PLATE DILATOMETER TEST (DMT- #)



VANE SHEAR TEST (VST- #)



PERCOLATION / INFILTRATION TEST (PT- #)



TEST PIT (TP- #)



\*\*\* End of Section \*\*\*



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INCLUDING WATER AND SEWER**

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**CHAPTER A-1**  
**SITE DEVELOPMENT,**  
**INCLUDING WATER AND SEWER**

**1.1 GENERAL**

This chapter presents general requirements for the preparation of plans, specifications, and design analysis.

**1.1.1 Scope.**

This chapter states criteria requirements and guidance for site development design, including water and sewer (see the appropriate chapters for electrical and mechanical requirements). Specific submittal requirements in this chapter supplement the requirements in Volume 1.

**1.1.2 Site Development Quality.**

It is the objective of the Savannah District to obtain an efficient, economical, and sustainable site layout.

**1.1.3 Water Supply System.**

Water supply systems include sources, pumping, treatment, storage, and distribution of water used for domestic, industrial, irrigation, and fire protection. Many military installations have privatized their water supply distribution system. A-E shall coordinate their water supply system design with the privatized utilities to the demarcation line.

**1.1.4 Wastewater Collection System.**

Wastewater systems include collection, pumping, treatment, and disposal of domestic and industrial wastes. Many military installations have privatized their wastewater collection system. A-E shall coordinate their wastewater collection system design with the privatized utilities to the demarcation line.

**1.1.5 Sustainable Design.**

The U.S. Army Corps of Engineers has a policy to support the design, construction, operation and reuse/removal of the built environment (infrastructure and buildings) in an environmentally and energy efficient manner. Site development contributions include salvage/reuse opportunities, waste reduction, low impact development practices for controlling (LID) rain runoff, native plant selection, and close collaboration with all team members and User to synthesize successful sustainable design solutions. Chapter 14, Sustainable Design, contains detailed requirements.

**1.1.6 Antiterrorism/Force Protection.**

Site layout shall be designed in accordance with UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings.

**1.1.7 Site Adapting.**

Site adaptations of similar project designs approved for other locations are acceptable. The site adaptation shall comply with the Installation Design Guide, state and local regulations, and referenced criteria.

### 1.1.8 Survey.

The A-E shall perform the topographic survey, unless otherwise instructed in the project Specific Instructions.

### 1.1.9 Erosion Control.

The A-E shall obtain a state approved erosion control plan prior to the final submittal, unless otherwise instructed in the project Specific Instructions. The A-E is responsible for all permitting fees.

### 1.1.9 Storm Water Quality.

The A-E shall obtain a state approved storm water quality permit when required by the state in which the project resides. The A-E is responsible for all permitting fees.

### 1.1.10 Septic Tank and Leach Field.

The A-E shall obtain a state/local county approved septic tank and leach field permit when required by the state/local county in which the project resides. The A-E is responsible for all permitting fees.

## 1.2 APPLICABLE PUBLICATIONS

The following publications form a part of this Manual to the extent indicated by the references thereto. Where a publication date is not indicated the current version at the time of contract award is applicable

### 1.2.1 Unified Facilities Criteria (UFC).

UFC 1-300-02	Unified Facilities Guide Specifications (UFGS) Format Standard, with Changes
UFC 1-300-07A	Design Build Technical Requirements
UFC 3-201-01	Civil Engineering
UFC 3-201-02	Landscape Architecture
UFC 3-210-10	Low Impact Development
UFC 3-230-01	Water Storage and Distribution
UFC 3-230-03	Water Treatment
UFC 3-240-01	Wastewater Collection and Treatment
UFC 3-250-01	Pavement Design for Roads and Parking Areas
UFC 3-250-03	Standard Practice Manual for Flexible Pavements
UFC 3-250-04	Standard Practice for Concrete Pavements
UFC 3-250-06	Repair of Rigid Pavements Using Epoxy Resin

	Grouts, Mortars and Concretes
UFC 3-250-07	Standard Practice for Pavement Recycling
UFC 3-250-08FA	Standard Practice for Sealing Joints and Cracks In Rigid and Flexible Pavements
UFC 3-250-09FA	Aggregate Surfaced Roads and Airfields Areas
UFC 3-250-11	Soil Stabilization for Pavements
UFC 3-260-01	Airfield and Heliport Planning and Design
UFC 3-260-02	Pavement Design for Airfields
UFC 3-260-03	Airfield Pavement Evaluation
UFC 3-260-4	Airfield and Heliport Markings
UFC 3-260-11FA	Model Design-Build (D-B) Request for Proposal (RFP) For Airfield Contracts
UFC 3-260-17	Dust Control for Roads, Airfields and Adjacent Areas
UFC 3-270-01	O&M Manual: Asphalt and Concrete Pavement Maintenance and Repair
UFC 3-270-07	O&M: Airfield Damage Repair
UFC 3-270-08	Pavement Maintenance Management
UFC 3-280-04	Army Filtration of Liquids
UFC 4-010-01	DoD Minimum Antiterrorism Standards for Buildings, including Changes
UFC 4-010-03	Security Engineering: Physical Security Measures For High-Risk Personnel
UFC 4-020-01	DoD Security Engineering Facilities Planning Manual
UFC 4-022-01	Security Engineering: Entry Control Facilities / Access Control Points
UFC 4-022-02	Selection and Application of Vehicle Barriers, with Change 1
UFC 4-022-03	Security Fences and Gates
UFC 4-214-03	Central Vehicle Wash Facilities

UFC 4-420-01    Ammunition and Explosives Storage Magazines

UFC 4-750-02N      Design: Outdoors Sports and Recreational Facilities

UFC 4-860-01FA                                      Railroad Design and Rehabilitation

NOTE: UFC are distributed in electronic media, only, and are effective upon issuance. UFC are available for downloading at [www.wbdg.org](http://www.wbdg.org).

## 1.2.2 State

### 1.2.2.1 Georgia

Manual for Erosion and Sediment Control in Georgia (Green Book)

Department of Transportation State of Georgia Standard Specifications Construction of Roads and Bridges

### 1.2.2.2 North Carolina

North Carolina Erosion and Sediment Control Planning and Design Manual

North Carolina Department of Transportation Standard Specifications for Roads and Structures

### 1.2.2.3 South Carolina

South Carolina DHEC Storm Water Management BMP Field Manual

South Carolina State Highway Department Standard Specifications for Highway Construction

## 1.2.3 National

NFPA 22    Water Tanks for Private Fire Protection

NFPA 20    Installation of Centrifugal Fire Pumps

NFPA 24    Installation of Private Fire Service Mains

AASHTO    A Policy on Geometric Design of Highways and Streets

Recommended Standards for Sewage Works (Ten States Standards)

Manual of Septic Tank Practice, U.S. Department of Health, Education, and Welfare

### **1.3 PRECONCEPT SUBMITTAL REQUIREMENTS**

#### **1.3.1 Submittal.**

Certain projects may be of such magnitude or significance that in order to select the best possible design the COE may require a study to be made prior to concept submittal. Where a pre-concept submittal is specifically called for, the designer shall submit a project site plan showing the building outline with supporting utilities.

#### **1.3.2 Pre-Concept Drawings.**

Provide the following plans. The plans shall be provided at a scale of 1" = 30', unless otherwise instructed in the project Specific Instructions. Provide one printed set and one CD of the complete site development drawing set. The drawings on the CD shall be in AutoCAD format and PDF.

##### **1.3.2.1 Location Plan with a vicinity map.**

1.3.2.2 Existing Topography Plan. Develop this drawing utilizing available site information, installation maps, existing surveys, etc. Show existing topography, scale, spot elevations, any bordering/adjacent roads and streets, existing structures, utility lines, or other site feature(s).

1.3.2.3 Site Layout Plan. Develop a site layout plan in sufficient detail so that the Savannah District, the installation, and the facility user may visualize the project and the project relationship with surrounding structures.

1.3.2.3 Site Utility Plan. Develop a site utility plan in sufficient detail so that the Savannah District, the installation, and the facility user may visualize the project's utility connections to the existing system.

### **1.4 CODE 3 DESIGN REQUIREMENTS**

#### **1.4.1 Submittal.**

Submittal content and format shall be project specific. Code 3 design requirements will be furnished in the contract or delivery order specific instructions.

### **1.5 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS**

#### **1.5.1 Site Development Narrative.**

Provide a general description of the project site. State handicapped accessibility requirements. Discuss design approach with respect to vehicular and pedestrian circulation within the site and integration with adjacent facilities. As a minimum, the narrative should address the items in the following paragraphs.

##### **1.5.1.1 General.**

a) Location of and access to the proposed project site, with brief explanation of objectives and factors influencing siting decisions.

- b) General overview of major planned site features, including: building orientation; surface drainage patterns; traffic circulation; parking provisions and pedestrian access, including provisions for the handicapped; security requirements; etc.
- c) Impact of new construction on existing facilities and considerations for future expansion.d) Existing site features, including: general topography, tree cover, acreage, boundaries, unusual subgrade conditions, etc.
- e) Former use of the site when major removals, demolition, and salvage are required.

#### 1.5.1.2 Demolition and Removals.

- a) Specific items requiring removal, relocation, or demolition and salvage should be identified.
- b) Disposition of salvaged or waste materials.
- c) Waste diversion.
- d) Description of trees to be removed, acreage, density, and species.

#### 1.5.1.3 Site Geometry.

- a) Rationale for locating major site elements.
- b) ATFP setback requirements and installation specific clearances.
- c) Areas for Low Impact Design features.

#### 1.5.1.4 Roads.

- a) Lane and shoulder widths and cross slopes.
- b) Requirements for curbs, sidewalks, guardrail, traffic signs and markings, fencing, etc.
- c) Intersection(s) or connection(s) to existing roads, streets or parking areas.
- d) Surface drainage features, both existing and proposed.
- e) Easements and rights-of-way.
- f) Traffic routing during construction.

#### 1.5.1.5 Parking and Open Storage Areas.

- a) Size, type, and number of vehicles to be accommodated.
- b) Number and size of individual parking spaces to be provided, including pedestrian access and number and location of handicapped parking spaces.
- c) Locations of parking or storage areas, including location of entrance and exit drives.

#### 1.5.1.6 Miscellaneous Site Features.

- a) Concrete curbing and curbs and gutters.
- b) Sidewalks - pedestrian circulation and width.
- c) Fencing - type, height, size and gate locations.
- d) Traffic signs - types and locations.
- e) Pavement markings.
- f) Guardrail and wheel stops.

#### 1.5.1.7 Site Grading.

- a) Rationale for grading plan.
- b) Finished floor elevation (FFE).
- c) Cut and fill, including estimated quantities.

#### 1.5.1.8 Storm Drainage.

- a) Connections and impacts to the existing storm drainage system.
- b) Methodology for handling roof runoff from gutter downspouts.
- c) Unique storm drainage structures.



- d) Types of materials to be specified for storm drains, culverts and drainage structures.
- e) Proposed features and methods to meet EISA 438 and local state water quality requirements.

#### 1.5.1.7 Pavement.

Identify the types and locations of pavements.

#### 1.5.1.8 Erosion Control.

Identify practices/measures proposed for the project site.

#### 1.5.1.9 Water and Sewer.

- a) Provide statement who will be designing and constructing the water and sewer utilities beyond the 5 foot line from proposed building face.
- b) A-E designs shall provide a description of the system proposed for both water and sewer. Description shall include materials, unique measures needed and the rationale for the proposed layout of the water and sewer systems.

#### 1.5.1.10 Landscape.

Provide analysis of existing site conditions, including an indication of existing plant materials that are to remain on the project site. Identify specific site problems related to proposed development and the rationale for proposed plant selection and locations. A list of suggested types and sizes of plant materials, based upon the approved plant list, should be included.

#### 1.5.1.11 Specification List.

Provide a list of Unified Facilities Guide Specifications (UFGS) to be used for this project. UFGS are available for downloading at [www.wbdg.org](http://www.wbdg.org).

#### 1.5.1.12 Additional Information.

Provide a tabulation of any design data not received that will impact completion of final design.

### 1.5.2 Design Calculations/Analyses.

#### 1.5.2.1 Pavements.

Pavements shall be designed in accordance with the technical requirements in paragraph 1.10 of this chapter. Provide the PCASE design printouts.

#### 1.5.2.2 Storm Drainage.

Provide methodology for calculating storm drainage pipe sizes and other storm water structures. Identify design storm and frequency. Include initial computer printout or calculation spreadsheets analyses.

#### 1.5.2.3 Water Distribution Mains.

If the installation water system is not privatized, the analysis for exterior building water service lines shall show flow, velocity and pressure drop between the water main and building, and pipe sizes. Provide a Hardy Cross, or other approved methods, flow analysis, if new water distribution mains are required. This shall consist of a flow analysis of the proposed new mains using fire demands developed from criteria. The flow around all loops shall be balanced by use of the Hardy Cross system of analysis or other approved means. In developed areas where the existing distribution mains appear adequate, indicate the required fire demand and verify the adequacy of the existing system by a fire-flow test at a nearby hydrant. Frictional losses from test point to the site tie on should be included in the analysis. If the existing system is proved to

be inadequate to supply the fire demand, augmentation of the system will be required. The A-E shall determine whether fire pump station/ground storage reservoirs are required.

#### 1.5.2.4 Sewer System.

If the installation sewer system is not privatized, no design analysis of gravity house sewers will be required unless the sewage flow exceeds the capacity of a 6-inch pipe on a 0.6 percent slope. A design analysis is required for pneumatic ejectors, sewage pumps, sump pumps, and hydro-pneumatic systems. The analysis shall show sewage flows, velocities, pipe sizes, elevations, and pipe capacities. Where new sewage collection systems are to be connected to the existing system, the existing sewage collection system will be checked downstream for five or more existing manholes to see if it is adequate for the added flow. New sewage flow will be added to the existing flow to determine the impact of the increased flow. Design analysis shall be furnished for sewage lift stations and force mains showing flows, velocities, component capacities, head requirements, detention periods, etc. Design analysis will be required for septic tanks and tile fields. The A-E shall determine the feasibility of a septic tank and tile field where buildings are remotely located and it is uneconomical to make normal house connections into an existing main. Soil percolation tests will be conducted by the A-E, unless otherwise specified. Oil/water separators shall be designed in accordance with API criteria and be capable of removing free and effluent oil globules greater than 15 mg/L and provide no greater than 15 mg/L free oil concentration effluent.

#### 1.5.3 Concept Drawings.

Submit the following drawings. Drawing scale shall be 1"=30', unless otherwise instructed in the project Specific Instructions. Provide one printed set and one CD of the complete site development drawing set. The drawings on the CD shall be in AutoCAD format and PDFs.

##### 1.5.3.1 Location Plan (GI).

Indicate the location of project site, the Contractor's designated access and haul routes to the site, access control point, borrow and disposal areas, and the Resident Engineer and DPW offices with addresses and telephone numbers. Add any installation specific notes.

##### 1.5.3.2 Existing Topography Plan (VF).

Include existing utilities with the site topography and all information from project survey. Survey information shall follow the AEC standards except as follows:

Existing topographic contours line style shall be dashed in lieu of continuous.

##### 1.5.3.3 Civil Drawings (C).

Include general civil notes and legends.

##### 1.5.3.3.1 Removal and Demolition Plan (CD).

Include all items to be demolished and removed by the contractor including clearing and grubbing. Items to be removed shall be hatched. If removal is extensive and drawings will become cluttered, break removal and demolition into site features and the other as utilities.

##### 1.5.3.3.2 Site Layout Plan (CS).

Include all proposed site elements per DD1391, dimensions, coordinates and notes specific to this sheet. Do not show items removed. Provide site details if available.

##### 1.5.3.3.3 Grading and Storm Drainage Plan (CG).

Include proposed site grading scheme with locations of proposed LID features, storm drainage pipe routing with proposed structures and notes specific to this sheet. Do not show items removed. Provide grading and storm drainage details if available.

#### 1.5.3.3.4 Utility Plan (CU).

Include proposed water and sewer routing with proposed structures and valves and notes specific to this sheet. Show other utilities (existing and proposed). Do not show items removed. Provide utility details if available.

#### 1.5.3.3.5 Erosion Control Plan (CE).

Included conceptual location of proposed erosion control measures for the proposed site layout in alignment with state nomenclature and notes specific to this sheet. Provide erosion control details if available.

#### 1.5.3.3.6 Landscape Plan (LS).

Not required for concept drawings.

#### 1.5.4 Comment Annotations.

All pre-concept comments inserted into ProjNet shall be incorporated into the drawings and/or addressed within ProjNet.

### **1.6 PRELIMINARY (OVER THE SHOULDER) DESIGN SUBMITTAL REQUIREMENTS**

#### 1.6.1 Purpose.

The purpose of this submittal is to check design progress at the Preliminary (60%) stage. Design should be at the preliminary stage but without the formal submittal and conference. Design does not stop at this submittal.

#### 1.6.2 Comment Incorporation.

All concept comments inserted into ProjNet shall be incorporated into the drawings and/or addressed within ProjNet.

#### 1.6.3 Drawings.

Concept submittal plans updated to the preliminary design stage.

### **1.7 PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS**

#### 1.7.1 Comment Incorporation.

Incorporate concept submittal review comments and approved value engineering (VE) suggestions. All comments inserted into ProjNet shall be incorporated into the drawings and/or addressed within ProjNet.

#### 1.7.2 Site Development Narrative.

Provide as indicated for Concept submittal; updated for design submittal with more detailed/finalized design information.

#### 1.7.3 Design Calculations/Analyses.

##### 1.7.3.1 Civil Calculations/Analyses

Submit complete calculations for pavement and storm drainage.

#### 1.7.3.2 Water System Calculations/Analyses

Submit complete calculations for water design if installation water and sewer system is not privatized. As a minimum calculations shall indicate available supply and pressure versus required supply, calculations to support selection of all equipment, pipe materials, pipe sizes and detailed hydraulic calculations for each system including the worst fire situation for the water distribution system.

#### 1.7.3.3 Sewer System Calculations/Analyses

Submit complete calculations for sewer design if installation water and sewer system is not privatized. As a minimum calculations shall support selection of all equipment and pipe sizes, discussion of pollution control authority requirements and design compliance with authority requirements, pipe materials and hydraulic profiles.

#### 1.7.4 Specifications.

The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

#### 1.7.5 Preliminary Drawings.

Provide one printed set and one CD of the complete site development drawing set. The drawings on the CD shall be in AutoCAD format and PDFs. Preliminary drawings shall be the Concept submittal drawings expanded to 60% completion. All civil drawing sections shall include all of their appropriate details, profiles and tables based on calculations and what is to be built. All utilities structures shall include all invert elevations, top of structures, type of structure, etc.

##### 1.7.5.1 Landscape Plan (LS).

Provide landscape plans. Plans shall include trees and shrubs planting details, planting schedules and other details as required. Irrigation plans if authorized shall be part of this preliminary (60%) submittal requirements. Irrigation plans shall irrigation zones, sprinkler head details, pipe material and sizes.

#### 1.7.6 Erosion Control Permit Package

Initial erosion control permit package shall be submitted to reviewing authority. Erosion control permit package shall be per the installation's permit procedure in accordance with the state requirements. Package includes all required drawings and analyses.

### 1.8 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS

#### 1.8.1 Comment Incorporation.

Incorporate Concept and Preliminary review comments. All comments inserted into ProjNet shall be incorporated into the drawings and/or addressed within ProjNet. Final design submittal is a complete design with approved permits with minor aesthetic changes.

#### 1.8.2 Site Development Narrative.

Provide as indicated for Concept submittal; updated for design submittal with finalized design information.

#### 1.8.3 Design Calculations/Analysis.

Submit design analyses, updated based on the final design. No additional analyses are required, if acceptable analyses were furnished with either the Concept or Preliminary Design Submittal.

#### 1.8.4 Specification.

Submit completed edited Unified Facilities Guide Specifications (UFGS) to be used for this project.

#### 1.8.5 Final Drawings.

Submit one printed set and one CD of the final drawings. The drawings on the CD shall be in AutoCAD format and PDFs. Final drawings shall be at a "ready for construction" design level with only grammatical errors.

#### 1.8.6 Erosion Control Permit Package.

Erosion control permit package shall already be approved or at the state office for approval two (2) weeks prior to the submittal of the Final (100%) submittal.

### 1.9 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**

In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

#### 1.9.1 Design Check.

Verify consistency between plans, specifications and final corrections.

### 1.10 **TECHNICAL REQUIREMENTS**

#### 1.10.1 Topographic Survey

The survey of the project site is intended to furnish complete information and data for design purposes. A topographic map of the estimated project area is usually furnished to the A-E by the District Project Manager. When the A-E is instructed to make the site survey, or to extend the survey due to site relocations, the work shall be performed under the supervision of a registered land surveyor, preferably registered in the State in which the project site is located.

##### 1.10.1.1 General.

Topographic surveys will be at a scale of 1" = 30 ft with 1 ft contours unless otherwise directed. All elevations taken in the field shall be spaced no more than 30ft apart. Units shall be US Survey Feet. Intermediate elevations shall be provided as necessary to show breaks in grade or changes in terrain or surfaces. Surveying and Mapping shall be in strict compliance with the pertinent sections of EM-1110-1-1003 NAVSTAR Global Positioning System Surveying, EM-1110-1-1005 Engineering and Design: Control and Topographic Surveying, EM-1110-1-2909 Geospatial Data and Systems, and Tri-Services A/E/C CADD Standards. The following is an

exception to the A/E/C CADD standard, existing topography contour line style shall be dashed. All text and dimensions shall be annotative.

#### 1.10.1.2 Control

Establish 2 permanent aluminum standard USACE monuments per topographic survey site, designations to be consistent with existing base monument designations, unless directed otherwise. Monuments shall be stamped with designator and year set. Temporary bench marks will be established on a grid of 500 feet so a minimum of two (2) appear for each final survey sheet. All of the control points recovered and/or established shall be plotted at the appropriate coordinate point in the drawing file and shall be identified by designation and elevation. The U-SMART form will be submitted for all permanent survey monuments established on this project.

##### 1.10.1.2.1 Horizontal

All of the control points recovered and/or established at the site shall be plotted at the appropriate coordinate point in the AutoCAD files and shall be identified by name (or number) and elevation. Horizontal control for surveys will be based on localized datum(s) unless otherwise directed. The survey monuments shall be set within the topo limits, but in an area where the best protection from construction is afforded. All of the horizontal control shall be referenced to local State Plane System, unit of US survey feet, with no less than third order accuracy and procedures. Contractor must indicate on the mapping what Coordinate System was used for the mapping.

##### 1.10.1.2.1 Vertical

Vertical control shall be referenced to NAVD 88, with no less than third order accuracy and procedures. All control leveling shall start from two previously established marks whose elevations agree with the limits of third order accuracy and should be tied to a mark of the same or a higher degree of accuracy. Side shots shall not be used in any control leveling. Contractor must indicate on the mapping what Coordinate System was used for the mapping.

#### 1.10.1.3 Required Data.

1.10.1.3.1 Survey of area, show property lines and ownership, and BMs/TBMs (locations, elevation(s), description(s)).

1.10.1.3.2 Finished floor elevations (FFE) of existing building(s).

1.10.1.3.3 Type and characteristics of all existing structures within survey limits, including building numbers.

1.10.1.3.4 Roads, streets, and trails; sidewalks; and paved areas, include the following information:

- (a) Type of construction (gravel, asphalt, etc.).
- (b) Condition of surface (cracked, potholed, etc.).
- (c) Street names.
- (d) Culverts: size, type, invert elevations, and condition.
- (e) Bridges: size, type, material, and condition.
- (f) Guardrail: location, and type of material.
- (g) Distance from storm drain inlets to trunk line.

(h) Curbs: type, spot elevations along gutter line, face of curb, back of curb and edge along pavement.

(i) Joint layout of "existing" airfield/hardstand pavements, with spot elevations at each joint intersection.

#### 1.10.1.3.5 Railroads, include the following information:

- (a) Alignment of track and location of road crossings.
- (b) Number of tracks and weight of steel rail.
- (c) Elevations along base of rail.
- (d) Locations of turnouts and sidings (station point of switch and turnout number).
- (e) Drainage structures: size, type, invert elevation and condition.
- (f) Name of serving company (CSX, etc.).

#### 1.10.1.3.6 Utilities.

Surveyor shall coordinate with local base authorities to determine location of existing lines. The field survey party will accurately locate all surface utilities within the mapping limits of the project. The use of as-built drawings, personnel on the site familiar with the area, local utility companies, electronic devices (pipe locator), and digging as required, will be utilized to prove the location and elevation of the utilities. Unless indicated otherwise, utilities shall be to Subsurface Utility Exploration (SUE) Level B. Survey shall capture and include the following information:

##### 1.10.1.3.6.1 Water.

- (a) Alignment of pipeline(s) within the project area.
- (b) Type (CI, PVC, etc.) and size of pipe.
- (c) Depth below existing ground line.
- (d) Storage capacity of tank(s).
- (e) Location of fire hydrants with top pipe elevation and pipe size, valve and valve boxes. Show all connections between valves and/or hydrants.
- (f) Valve locations.

##### 1.10.1.3.6.2 Sanitary Sewer Collection.

- (a) Alignment of pipeline(s) within the project area.
- (b) Type (RCP, DIP, etc.) and size of pipe.
- (c) Depth below existing ground line.
- (d) Manholes: size and top and invert elevations. Show a minimum of two connecting manholes. Extend sewer pipe survey outside the survey limits to the next downstream/upstream manhole. Show azimuth and distance to next manhole outside the project limit and the manhole's data.

##### 1.10.1.3.6.3 Storm Drainage.

- (a) Alignment of pipe lines within the project area.
- (b) Type (CMP, RCP, etc.) and size of pipe.
- (c) Depth below existing ground line.
- (d) Manholes: size and top and invert elevations.
- (d) Profile of open ditches above and below culverts and surface inlets.
- (e) Inlets: top and invert elevations, and number and size of grates. For curb type inlets with no grate, give length of opening, invert elevation at throat (gutter line), and top elevation of structure directly over the opening.
- (f) Dimensions of inlet structure(s).

- (g) Headwalls: give type, dimensions, pipe diameter(s) and invert elevation(s) at end(s) of pipe.
- (h) Where pipe terminates in ditch without a headwall, indicate if flared end section (FES) or end of pipe is in good condition or damaged. Also, if ditch is stabilized or eroded.
- (i) Where storm drainage pipe extends beyond survey limits, secure length and invert elevation of pipe at next structure upstream or downstream to determine percent slope of pipe.
- (j) Where storm drainage pipe extends beyond survey limits, secure length and invert elevation of pipe at next structure upstream or downstream to determine percent slope of pipe.

#### 1.10.1.3.6.4 Electrical Power.

- (a) Alignment of powerlines (aerial or underground) within the project area.
- (b) Pole locations and heights.
- (c) Transformers: Number and size.
- (d) Service lines: Number of wires, size and material; voltage and phase; height of line above existing ground line.
- (e) Name of serving company.

#### 1.10.1.3.6.5 Communication.

- (a) Alignment of lines, (aerial or underground) within the project area.
- (b) Pole locations and heights.
- (c) Number of wires, size and material; height above existing ground line at pole.
- (d) Manholes, hand holds, duct bank or direct bury
- (e) Name of serving company.

#### 1.10.1.3.6.7 Gas and Fuel Service.

- (a) Alignment of pipe lines within the project area.
- (b) Type (Steel, Plastic, etc.) and size of pipe
- (c) Meters, valves, tank size and material, etc

#### 1.10.1.3.6.7 Central Heating and Cooling.

- (a) Type of pipes and system
- (b) Alignment and elevations of distribution lines, locations, anchors, manholes, traps, valves, and expansion loops
- (c) Concrete trench or direct bury

#### 1.10.1.3.7 Vegetation.

- (a) Groundcover
- (b) Brush.
- (d) Trees: species, diameter, height, condition, location of trees 4 inches and larger in diameter on the project site.

#### 1.10.1.3.8 Fencing.

- (a) Type and location (alignment), including location(s) and size of gates.
- (b) Number of barbed wires on extension arm, where applicable.
- (c) Height and type of fabric.
- (d) Kind of posts and condition.



(e) General condition of fence as a whole.

1.10.1.3.9 Endangered Species Habitat.

- (a) Show location(s) of nesting or den trees.
- (b) Prominently mark/identify trees for Contractor's ease in preserving same during construction operations.

1.10.1.3.10 Wetlands

- (a) Show locations of any delineated wetlands.
- (b) Where required, survey shall obtain services to identify, mark limits, and obtain certification of wetlands delineated.

1.10.1.4 Additional requirements for Boundary and Easement Surveys.

- (a) Install iron pins for horizontal control, showing locations and coordinates.
- (b) Indicate ties to existing base lines, land corners, and either the installation's or state plane coordinate system, when applicable.
- (c) Show property line locations with distances and bearings, when applicable.

1.10.1.5 Digital Data

The survey data shall be placed into an AutoCAD (Civil 3D version 2018) file. All text shall be annotative text. Use the specifications as described in the latest release of the A/E/C CADD Standards latest version. The standards can be downloaded on the CADD/GIS Technology Center web site at <https://cadbimcenter.erdcdren.mil/>.

1.10.1.6 Deliverable Products

- (a) The contractor shall provide the government with the digital (native) files by email or by other digital file transfer means acceptable to government.
- (b) An ASCII text file of all points collected.
- (c) A triangular interpolated network (TIN) file and a surface or DTM created from topographic data.
- (d) U-SMART form. Contractor shall submit evidence (field notes, OPUS solutions, NGS datasheets etc.) to show that control monumentation was set to the required Order.
- (e) A bound copy of all field notes, picture, etc. gathered to create topographic survey.
- (f) Surveyor signed and sealed PDF – full size survey.
- (g) The contractor shall keep a copy of the digital data for a period of one year from the date of final government acceptance. The digital data shall be made available to the government upon request, at no additional cost.

1.10.2 Special Requirements.

The chief of the survey party shall coordinate with the installation concerning all existing utility lines to be shown on the survey to ensure that every effort has been made to obtain correct and complete information regarding utility locations.

1.10.2.1 Special Ft. Bragg, N.C. Layout Plan Requirements.

- (a) A single model file or map of the entire site indicating the location of all existing and proposed utilities and other constructions to include the footprint of structures, paving (including curbing), sidewalks, and other relevant planimetric features at the completion of the project. Provide a separate file for base bid and options.
- (b) Due North on the map will be as viewed from the bottom of the map.

- (c) The map will contain a labeled coordinate grid with spacing appropriate to the map extents. For instance, a map scale of 1"=30' will have coordinates labeled at 100' intervals north/south and east/west.
- (d) A minimum of four tie-in points will be labeled on the map located near the four corners of the map. The tie-in points will show a symbol at the location of the point and a label indicating the Northing and Easting of each point.
- (e) All utilities on the map will be clearly labeled as to size and material. Where utilities are to be enclosed in conduits or duct work, a section of the duct will be shown clearly indicating the dimensions and material of the duct, the contents of the duct such as wire size and type of conductor, whether conductor is primary or neutral, number of conductors, hotwater supply or return, pipe size, insulation type and thickness, etc.
- (f) The map will show the invert elevation of all manholes as well as the invert of each pipe joining a manhole as well as the invert and character of all outfalls.

### 1.10.3 Storm Drainage Design.

The design storm shall be per EISA 438 and/or the applicable state criteria for erosion and sediment control and/or state criteria for water quality. The storm drainage design shall follow to the strictest criteria.

#### 1.10.3.1 Pipe Material Restrictions.

Due to the corrosive action of the soils, do not use aluminum pipe at Fort Stewart, Georgia, Kings Bay Naval Station, Georgia, and Sunny Point Military Ocean Terminal, North Carolina. Pipes installed beneath pavements shall be reinforced concrete pipes (RCP).

#### 1.10.3.2 Inlets.

All inlet, grate, or weir openings must be checked for size to be certain that the opening(s) will pass the calculated storm run-off draining to each inlet.

#### 1.10.3.3 Pipe Joints.

Provide watertight joints for storm drainage pipe.

#### 1.10.3.4 Pipe Sizes.

Minimum pipe diameter for roof drain collector system(s) shall be 6 inches. Provide cleanout at all 90 degree bend in roof drains and where run is greater than 150 feet between cleanouts. Minimum pipe diameter for enclosed storm drain system shall be 15 inches.

#### 1.10.3.5 Calculations and Drainage Area (DA) Map.

Complete calculations and drainage area map used for the design analysis must be submitted at same time drawings are submitted for review and comments. The DA map shall be at the same scale as the Grading Plan, unless otherwise instructed. Portions of the drainage area may lie outside the proposed project limits. If so, these off site areas must also be included in the design analysis of the storm drainage system. If not included in the topographic site survey, use USGS Quad Sheets, etc. to determine extent of off site areas. A factor of safety of 1.5 is used for paved areas. In vegetated areas where grass clippings and trash may clog the inlets, use a safety factor of 2.

#### 1.10.3.6 Culverts.

Culverts shall be designed using the applicable state Department of Transportation culvert design criteria. The A-E designer shall also inspect the outfall channel or drainage way below

each outlet to determine if the outfall ditch capacity and slope protection should be modified for the additional flows.

#### 1.10.4 Pavement Design.

All pavement design shall be in accordance with the latest version of the Pavement-Transportation Computer Assisted Structural Engineering (PCASE) program. The program may be downloaded from [www.pcase.com](http://www.pcase.com).

##### 1.10.4.1 Flexible Pavement.

Flexible pavement will usually be specified for driveways, roads, streets, parking areas, and shoulders of airfield runways and taxiways.

##### 1.10.4.2 Rigid Pavement.

Rigid pavement is used for tactical equipment shop hardstands, aircraft parking aprons and all service areas where spillage of solvents (gasoline, oil and grease) occurs as a result of service and repair of vehicles, aircraft, and airfield runways and taxiways. The minimum flexural strength shall be 650 psi in 28 days for non-airfield pavement and 700 psi in 90 days for airfield pavement. No other strengths will be acceptable, unless otherwise specified in the Specific Instructions to the A-E.

1.10.4.3 Traffic. The A-E shall coordinate with the installation to secure an estimate of the type and size of vehicle(s) and the total number of vehicles anticipated to use the proposed pavements.

#### 1.10.5 Grading and Surface Drainage.

Finished earth grades adjacent to buildings shall be a minimum of six (6) inches below the finish floor elevation. The earth grade shall slope away at a rate of 5 percent for 10 feet. Finished earth grades pavements shall be sloped away from the immediate area at a rate of at least 5 percent for 10 ft. Grading for roadway pavement transverse slopes shall be a minimum of 1 percent, except at transition points with intersecting roadways where the slopes must vary as a function of the roadway design grade. Surface grades in parking areas shall be held to the minimum required for drainage, but shall be not less than 1 percent, measured perpendicular to the finished grade contours. For safety reasons, the maximum cross slope grades for parking areas designed for 90-degree parking are 5 percent along the aisles through the area and 1-1/2 percent for the transverse slope. For parking areas designed for 60-degree and 45-degree parking, the maximum cross slope grades are 5 percent along the aisles through the area and 1 percent for the transverse slope. Combination curb and gutter shall usually be used around all vehicle parking area(s) and also along approach drives to control surface drainage, provide vehicle barriers and present a neat appearance. The curb and gutter shall be sloped a minimum of 0.30 percent to prevent ponding and assure positive drainage to curb inlets.

#### 1.10.6 Erosion Control.

Erosion control plan shall be designed in accordance with the applicable state erosion and sediment control regulations. Erosion control permit package shall already be approved or at the state office for approval two (2) weeks prior to the submittal of the Final (100%) submittal. States with water quality permits shall mirror the erosion control submittal schedule.

#### 1.10.7 Road Design.

Plan and profile drawings are required for all road designs.

#### 1.10.8 Water and Sewer Permits.

Water and sewer permit shall be obtained by the privatized utility with information for flow and usage projections provided by the A-E. Where privatized utility contracts are not in place for the installation, the A-E shall obtain any water and sewer permits required for the project. The A-E is responsible for all permit fees and for obtaining all permits. The designer will prepare, sign, and submit documents for all permits. Permit requirements should be ascertained by the designer at the time of the concept submittal.

#### 1.10.9 Water System Criteria.

See extend of work required based on line of demarcation where utility is privatized.

##### 1.10.9.1 Building Services.

1.10.9.1.1 Water Service Connections. Size the building water service connections to meet the peak building demands. Pressure drop between street mains and buildings shall not exceed 10 psi/100 feet at these rates of flow. Provide valve or curb stop with box near connection to main.

##### 1.10.9.2 Fire Protection:

1.10.9.2.1 Distribution Mains and Fire Hydrants. The residual flow pressures at design flows shall not be less than 20 psi. The fire demand is determined by the sum of the fire flow, 50 percent of the average domestic demand rate, and any industrial demand that cannot be reduced during a fire period.

1.10.9.2.2 Fire hydrants shall be provided in accordance with NFPA 24. Each building should be within 300 feet of at least two hydrants. Fire hydrants will have gate valves on service lines. Hydrants should not be located closer than 25 feet to a building and should be located not more than 7 feet nor less than 6 feet from the edge of a paved roadway surface. Residual pressures at fire hydrants should not be less than 10 psi when flowing at the desired rate.

1.10.9.2.2 Building Sprinkler Supply Mains. Sprinkler supply mains shall be at least the size required by the National Fire Protection Association. The existing distribution system shall be augmented to provide at least a 15-pound residual pressure at the highest sprinkler heads in the building at design fire demands. Provide cutoff valves with boxes on the supply mains. These shall be located not less than 25 feet nor more than 50 feet from the face of the building which they are to serve. They may be of either the post indicator type or the rising stem and yoke type installed in a pit, as indicator valves generally in grassed areas, and use the rising stem and yoke type installed in underground pits in paved areas. Fire pumping stations shall comply with NFPA Codes 20 and 24.

#### 1.10.10 Sewage Collection System Criteria

See extend of work required based on line of demarcation where utility is privatized.

1.10.10.1 Building Sewers (Sanitary). House sewers shall be of either the gravity type or the force main type as required by the building site conditions. Gravity type building sewers are preferred, and they shall be constructed of 6-inch minimum size pipe on at least 0.6 percent slope. Where gravity sewage connections to street collection mains cannot be provided, provide pneumatic ejectors or sewage pumps in the building. Duplex units shall be provided where ejectors or pumps are required. The capacity of each unit shall be sufficient to handle

the peak rates of flow. Operation of the pumps shall be lead-lag for single as well as combined capability.

1.10.10.2 Gravity Mains. Where more than one building is involved, use gravity type sewage collection mains. The minimum size of sewer mains (not house sewers) shall be 8 inches. The sewers will normally be laid on sufficient slope to provide a velocity of at least 2 feet per second at the average daily flow or average hourly flow rate and a minimum velocity of 2.5 - 3.5 feet per second at peak diurnal flow rate.

1.10.10.3 Force Mains and Sewage Lift Stations. Where more than one building is involved, if gravity type sewers cannot be provided, sewage pumps will be installed in a sewage lift station constructed on the lowest terrain in the vicinity. Force mains shall be constructed as straight, short, and shallow as possible. Where pumps operate in parallel or series, combined curves will be provided.

## **1.11 REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP PACKAGES**

### **1.11.1 General.**

Unless indicated otherwise, Army RFPs shall be prepared using the MILCON Transformation RFP template and the online RFP "wizard". Contact the SAS Project Manager for access to the RFP "wizard". Unless indicated otherwise, Air Force and all other RFPs shall be based upon "partial" design development as defined by UFC 1-300-07A. Survey requirements are located in paragraph 1.10.1, Technical Requirements.

### **1.11.2 MILCON Transformation RFP Template**

Develop complete RFP using current MILCON Transformation RFP Template documents and the online "wizard". Follow MILCON Transformation RFP Implementation Guidelines (located at the "wizard") in developing the RFP. Incorporate the basic premises of MILCON Transformation in the RFP.

### **1.11.3 Project-Specific Requirements.**

Coordinate with the Installation and develop SOW paragraph 6 (Project-Specific Requirements) and RFP appendices. Incorporate Installation Design Guide (IDG) to the extent that IDG compliance does not jeopardize project award within budget.

### **1.11.4 Installation Coordination.**

Coordinate with the Installation and provide technical support for Installation requests for deviations from MILCON Transformation RFP requirements as needed.

### **1.11.5 Draft RFP Submittal Requirements.**

Provide Statement of Work document to include project-specific requirements and appendices.

### **1.11.6 Final RFP Submittal Requirements.**

- (a) Implement draft RFP submittal review comments.
- (b) Verify consistency between drawings, appendices and RFP text.
- (c) Update RFP to reflect changes to MILCON Transformation RFP Template documents as needed during RFP preparation.

1.11.7 "Partial" Design Development RFP.

Prepare in accordance with UFC 1-300-07A. Unless indicated otherwise, A-E shall be furnished an electronic format sample or template for the written technical requirements portion of the RFP to be edited for the specific project.

\*\*\* End of Section \*\*\*

## CHAPTER A-2

Revised July 2020

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## CHAPTER A-2

### STRUCTURAL

#### 2.1 GENERAL

2.1.1 Mission and Function. The structural engineer is responsible for the investigation, design, and selection of the force resisting and load supporting members and their connections in a structure. Typical examples are foundations, walls, columns, slabs, girders, trusses, beams, diaphragms, and similar members. The investigation, design, and selection requires a knowledge of engineering laws, formulae, and practice; a knowledge of the physical properties of the materials used for such members; and a knowledge of the methods used in their erection.

2.1.2 Scope. This chapter states criteria, requirements, and guidance for structural design. Specific submittal requirements contained in this chapter supplement the requirements contained elsewhere in other volumes. All required documents, including the drawings and the design analysis, shall be prepared in accordance with applicable instructions. The Exhibits referenced in this chapter are located in Volume II, Chapter 2, STRUCTURAL.

#### 2.2 APPLICABLE PUBLICATIONS

The publications listed below, referred to hereafter by basic designation only, form a part of this manual and contain criteria to be used in the structural design. The publications can be separated into two divisions: industry publications (AASHTO, ACI, ASTM, ASCE, AISC, IBC, and NDS) and government publications (Unified Facilities Criteria, or UFC). UFC publications may be accessed from the Whole Building Design Guide website: [www.wbdg.org](http://www.wbdg.org). In the case that UFC publications are For Official Use Only (FOUO), they may be accessed from the Protective Design Center website after registering for an account: [www.pdc.usace.army.mil](http://www.pdc.usace.army.mil).

The applicable version of all UFC publications shall be the most recent version at the time the contract is awarded. The applicable version of industry publications shall be established using UFC 1-200-01, General Building Requirements. Additionally, UFC 1-200-01 describes how industry publications shall be modified by UFC publications.

The applicable version of industry and government publications shall include all addendums, supplements, and changes. This section is not intended to be an exhaustive listing of all publications that may be required for a particular project; additional criteria may be applicable.

##### 2.2.1 American Association of State Highway and Transportation Officials (AASHTO)

AASHTO                      LRFD Bridge Design Specifications

##### 2.2.2 American Concrete Institute (ACI)

ACI 318	Building Code Requirements for Structural Concrete
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 308R	Guide to Curing Concrete
ACI 360R	Guide to Design of Slabs-on-Ground
ACI 530	Building Code Requirements and Specification for Masonry Structures

### 2.2.3 American Society for Testing and Materials (ASTM)

ASTM A36	Standard Specification for Carbon Structural Steel
ASTM A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steels
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A992	Standard Specification for Structural Steel Shapes
ASTM F1554	Standard Specification for Anchor Bolts, Steel, 33, 55, and 105-ksi Yield Strength

### 2.2.4 American Society of Civil Engineers (ASCE)

ASCE 7	Minimum Design Loads for Buildings and Other Structures
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### 2.2.5 American Institute of Steel Construction (AISC)

AISC 360	Specification for Structural Steel Buildings
AISC 341	Seismic Provisions for Structural Steel Buildings
SCM	Steel Construction Manual

### 2.2.6 International Code Council (IBC)

IBC	International Building Code
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### 2.2.7 American Wood Council

NDS	National Design Specification for Wood Construction
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### 2.2.8 Unified Facilities Criteria

UFC 1-200-01	General Building Requirements
UFC 3-301-01	Structural Engineering
UFC 3-310-04	Seismic Design for Buildings
UFC 3-310-08	Non-Expeditionary Bridge Inspection, Maintenance, and Repair
UFC 3-320-06A	Concrete Floor Slabs on Grade Subjected to Heavy Loads
UFC 3-320-07N	Weight Handling Equipment
UFC 3-340-01	Design and Analysis of Hardened Structures to Conventional Weapons Effects (FOUO)
UFC 3-340-02	Structures to Resist the Effects of Accidental Explosions
UFC 3-710-01A	Code 3 Design with Parametric Estimating
UFC 4-010-01	DoD Minimum Antiterrorism Standards for Buildings
UFC 4-023-03	Design of Buildings to Resist Progressive Collapse

## 2.2.9 Guide Specifications:

<u>UFGS</u>	<u>TITLE</u>
31 62 13.20	Precast/Prestressed Concrete Piles
31 62 23.13	Cast-In-Place Concrete Piles, Steel Casing
31 62 16.16	Steel H-Piles
31 62 19	Timber Piles
31 62 21	Piling: Composite, Wood and Cast-In-Place Concrete
31 63 16	Auger Cast Grout Piles
31 63 26	Drilled Caissons
03 11 13.00 10	Structural Cast-In-Place Concrete Forming
03 20 00.00 10	Concrete Reinforcing
03 30 00	Cast-In-Place Concrete
03 30 53	Miscellaneous Cast-In-Place Concrete
03 51 01	Precast Roof Decks
03 55 16	Gypsum Concrete Floor Planks
05 05 23	Welding, Structural
05 05 23.13 10	Ultrasonic Inspection of Weldments
41 36 30.00 10	Ultrasonic Inspection of Plates
05 12 00	Structural Steel
05 21 19	Open Web Steel Joist Framing
05 30 00	Steel Decks
05 40 00	Cold-Formed Metal Framing

2.2.10 Structural Related Guide Specifications. The following guide specifications are prepared by other disciplines but frequently require structural review and input:

<u>UFGS</u>	<u>TITLE</u>
03 33 00	Cast-In-Place Architectural Concrete
03 45 00	Precast Architectural Concrete
04 20 00	Masonry
05 50 13	Miscellaneous Metal Fabrications
06 10 00	Rough Carpentry
07 42 13	Metal Wall Panels
07 61 14.00 20	Steel Standing Seam Roofing
08 33 23	Overhead Coiling Doors
08 36 13	Sectional Overhead Doors
13 48 00	Seismic Protection for Miscellaneous Equipment
13 34 19	Metal Building Systems
33 16 15	Water Storage Steel Tanks
14 21 00.00 20	Electric Traction Elevators
14 24 00	Hydraulic Elevators
41 22 13.14	Bridge Cranes, Overhead Electric, Top Running
41 22 13.15	Bridge Cranes, Overhead Electric, Under Running

**2.3 PRECONCEPT SUBMITTAL REQUIREMENTS** No submittal requirements.

## **2.4 CODE 3 DESIGN REQUIREMENTS**

2.4.1 Submittal. Submittal content and format shall be as described in UFC 3-710-01A, "Code 3 Design with Parametric Estimating."

## **2.5 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS**

The structural portion of the concept brochure must outline the proposed methods and materials of design and construction for approval. An outline of the required brochure is shown in Exhibit A-2-3. The design submittal shall include the following:

### **2.5.1 Structural Narrative:**

2.5.1.1 General: Use present tense wording for all paragraphs. Provide a general description of the scope of the project and all of the major structures. Give overall building dimensions and a description of the principal features such as wall and roof construction. If the building is irregularly shaped, explain where seismic joints will be placed to create regular shapes or provide a statement that a dynamic analysis of the building will be performed (seismic joints are preferred for most structures designed by the Savannah District).

2.5.1.2 Framing System: Provide a brief description of the gravity framing system and lateral framing system chosen and the reasons why. Provide a brief description of how the lateral forces will be transmitted into the foundations. If a Structural System Comparative Selection Analysis (Section 2.5.3) is required then this paragraph should summarize the results of that analysis. The analysis will appear later in the outline and shall justify the system selection.

2.5.1.3 Foundation: Give a brief description of the anticipated foundations based on similar construction in the area.

2.5.1.4 Special Design Features: Briefly describe special features of the structural design including, but not limited to, resistance to progressive collapse and blast resistant glazing.

2.5.1.5 Fire Resistance Statement: State the required fire resistance criteria for all portions of the structural system and the proposed method of meeting these requirements.

2.5.1.6 Outstanding Structural Information: List the information that is needed from other disciplines to complete the final structural design.

### **2.5.2 Concept Structural Design Analysis:**

2.5.2.1 Load Assumptions: State the dead and live loads for which the facility is to be designed, including roof loads, floor loads, and crane loads. Calculate the wind loads, lateral earth pressure loads, seismic loads, etc., as applicable.

2.5.2.1.1 Dead Loads: tabulate all dead loads used and provide references for atypical materials.

2.5.2.1.2 Live Loads: tabulate all relevant live loads using the APPLICABLE PUBLICATIONS.

2.5.2.1.3 Wind Loads: Provide both main wind force resisting system (MWFRS) wind pressures and components and cladding (C&C) wind pressures. Both positive and negative wind pressures shall be included with the controlling pressures summarized in tabular form.

2.5.2.1.4 Seismic Loads: calculate the seismic loadings for the lateral load resisting system and contrast them with the comparable wind loads. Detailed calculations for seismic loads on diaphragm connections and other parts and portions are not required at this submittal level. Insert sheet indicating that detailed calculations will be furnished for the preliminary (60%) design package.

2.5.2.1.5 Crane Loads: provide crane loads if applicable.

2.5.2.1.6 Antiterrorism and Force Protection/Progressive Collapse Analysis: Provide a description of any structural features required to meet ATFP requirements. A discussion of applicable Progressive Collapse system and design approaches shall also be provided.

2.5.2.2 Material Strength & Allowable Stresses: tabulate the values to be used for material strength (for LRFD design) and/or allowable stress (for ASD design) of the principal structural materials such as concrete, structural steel, reinforcing steel, concrete masonry, and others.

2.5.2.3 Calculations: provide all calculations for wind loading, seismic loading, and snow loading. No additional structural calculations are required to be completed at this submittal, but any additional calculations that have been performed must be included in the submittal for review.

2.5.4 Concept Drawings. Furnish sufficient framing plans for foundations, floors, and roof, as applicable, to indicate the preliminary layout of principal members including the locations of lateral force resisting elements. Typical sections should be furnished through roof, floor, and foundation indicating materials and type of construction proposed. These details may be shown on the architectural drawings. Furnish a plan identifying the location of all seismic joints, if necessary. Concept structural drawings must include general notes.

2.5.5 Outline Specifications: The Engineer shall review the list of guide specifications in this section and shall list those sections he or she proposes to use at the end of his concept narrative.

2.5.6 Specific Instructions: Furnish a copy of the Specific Instructions (as prepared by SAS) with the 35% submittal.

## 2.6 **PRELIMINARY (OVER THE SHOULDER) (60%) SUBMITTAL REQUIREMENTS**

2.6.1 Submittal: refer to SDDM Volume I Chapter 9.3.1 for submittal requirements.

## 2.7 **PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS**

The preliminary design will represent approximately 60 percent of the total structural design effort.

2.7.1 Preliminary Design Analysis: The preliminary design analysis shall include all items in the Concept design analysis and any revisions necessitated by comments from the Concept review. The design analysis will be substantially complete for all the major structural features of

the primary structure and will include but not be limited to the following:

- a. A brief structural narrative that provides the references, design loads, assumed material strengths, and a brief description of the structure to include type of foundation, type of framing, and method of resisting lateral loads.
- b. A synopsis of special design criteria or technical requirements provided as a result of site visits or correspondence with the Army Corps of Engineers Project Managers. Copies of any letters or minutes of meetings which provide structural guidance not otherwise contained in this manual should be included in this section of the design analysis.
- c. Complete calculation of seismic and wind loads for final design to include distribution of these loads to the lateral load resisting elements.
- d. Design calculations for roof and floor decks, beams, joists, girders, and columns as applicable.
- e. Design calculations for horizontal diaphragms and bracing to include shear transfer connections.
- f. Design calculations for exterior cladding (masonry, steel, precast concrete) for flexure, shear, and overturning as appropriate.
- g. Design calculations for shear walls, bracing, moment frames, and all other elements of the lateral force resisting system and their connections.
- h. Preliminary design calculations for antiterrorism and force protection systems and progressive collapse analysis, as applicable. Complete design analysis and calculations are required at final design.
- i. Checking of the design at this stage will not be required. This submittal will not normally include the design of lesser related structures such as utility vaults, pits, tanks, retaining walls, tank hold down pads, etc. The design analysis of these structures is required at final design.

2.7.2 Preliminary Drawings: This submittal will include the following as applicable:

- a. Foundation plans, framing plans for each floor, and roof plans for the building. Plans must indicate locations of bracing or other lateral force resisting elements. Grid lines on center lines of columns shall be indicated on the plans for buildings framed with columns and beams.
- b. Elevations of braced bays must be included if braced frames are used for lateral force resistance.
- c. Layout of floor joints in slab on grade. Layout of construction joints, control joints, expansion joints, and seismic joints in foundation, floor, and building framing.

- d. Typical sections through foundations, floors, and roof framing for buildings.
- e. Plans and sections of structures other than buildings.
- f. Additional sections and details as required illustrating any special items or methods of framing for which approval is sought.
- g. General, foundation, and superstructure notes as shown in Exhibit A-2-2.
- h. Future expansion information shall be noted on plans.

2.7.3 Preliminary Specifications: The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

## 2.8 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS

2.8.1 Design Analysis: The final design analysis shall include all items in the Preliminary design analysis and any revisions necessitated by comments from the Preliminary review. Furnish complete checked calculations for all structural members.

2.8.2 Drawings: Furnish complete final plans and details of all structural elements. Prior to this submittal, structural drawings shall be coordinated with all other design disciplines. Show on drawings a complete set of general and special notes as shown in Exhibit A-2-2. The items listed below will always be included on the final drawings if applicable:

- a. Roof framing plan and details including details of any opening in the roof, elevations of framing members, bearing on walls, etc.
- b. Intermediate floor framing plans and stair details on multiple story structures.
- c. Load diagrams of features to be contractor designed (i.e., light gauge truss or steel joist load diagrams, bracing loads for connection design, etc).
- d. All required schedules, including but not limited to beam schedules, column schedules, slab schedules, wall schedules, foundation schedules, and anchor bolt and base plate schedules.
- e. Foundation plan including any notes relative to special foundation treatment required and cross references to proper specification sections. Approximate locations and details for stepped footings shall be provided.
- f. Foundation sections and details.
- g. Layout of expansion, construction, and contraction joints in floor slabs; horizontal and vertical joints in foundation walls; joints in footings; and layout of control joints in

masonry walls.

- h. Typical and special sections as required.
- i. Details of expansion, construction, and contraction joints in concrete.
- j. Layout and detail of exterior entrance pads and steps.
- k. Details of any special items.
- l. General and special notes as required except that the term "by others" shall not be used.

2.8.3 Specifications: Submit a completed set of final specifications for review. Delegated design items shall be completely coordinated and addressed in the specifications.

2.8.4 Quality Assurance: Final drawings and specifications shall be checked by the same checker who checks the final design analysis. Structural drawings shall be coordinated with the other disciplines and the specifications. Dimensions, schedules, sections, and details shall be fully checked. Designers and checkers shall initial the pages of the design analysis and on the drawings. Exhibit A-2-4 is a sample of the quality review checklist that will be used by the District to review final design. The A-E is encouraged to use this, or a similar form, to review the final checked design documents. Completed design review checklists shall be submitted as a part of the submittal package.

## 2.9 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**

2.9.1 General: In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

2.9.2 Design Analysis: Furnish final structural calculations, incorporating any and all changes made during the process of review and redesign. Calculations will be checked and verified by an engineer other than the original designer.

2.9.3 Drawings: Drawings will implement all comments from previous submittals. Verify that all drawings are finalized and verify consistency between the plans and specifications.

## 2.10 **ADDITIONS OR MODIFICATIONS TO EXISTING STRUCTURES**

2.10.1 New Work: When new work is added to an existing structure or an existing structure is modified, the Engineer will be responsible for determining the adequacy of the existing structure for the addition or modification. This includes, but is not limited to, projects that place a sloped roof over an existing flat roof.



2.10.2 Inspection Report: An inspection of the existing structure shall be performed for the purpose of determining the condition and measurements of the areas affected by the new work. The Concept Design shall include a narrative that outlines the results of this inspection to include describing the layout and details of the existing structure, stating the calculated capability of the structure to support the new loads, and describing the strengthening that will be required.

2.10.3 Seismic or Wind Upgrade: Seismic or wind upgrade of the existing structure to meet the latest criteria will not be required unless specifically stated in the Structural Specific Instructions (prepared by SAS) or required by applicable Code requirements.

## 2.11 SITE ADAPTS OF GOVERNMENT DESIGNS

2.11.1 Concept: The concept brochure shall be as previously described with the following clarifications:

- a. A selection analysis is not required.
- b. Wind and seismic calculations shall be performed to verify that the controlling lateral loads are higher or lower than the original design. Redesign of the structural features to resist the higher loads will be required and the narrative will fully describe those items to be strengthened.

2.11.2 Final Design: Final design shall consist of complete plans, specifications, and design analysis. The specifications shall be the project specifications updated to include the latest revisions to the Federal and Military guide specifications, design codes, and other criteria. The design analysis shall include a narrative explanation of all changes to the original design to accomplish the site adaptation with backup calculations.

## 2.12 GENERAL DESIGN REQUIREMENTS

2.12.1 Technical Requirements: Design will be accomplished in accordance with the basic criteria provided herein and in the Specific Instructions (prepared by SAS) to the A-E.

2.12.2 Design Analysis: The design analysis shall be prepared in accordance with the general requirements contained in Volume I of this manual and the requirements of this chapter.

2.12.2.1 Computer Analysis: Analysis and design using computer programs is encouraged. The cover sheet of the structural calculations must identify what program(s) is (are) used. Listed below are the commercially available programs currently used in the Structural Section. These or other similar programs may be used except that use of a program not listed will necessitate the submission of the following additional information for that program:

- a. The name of the program.
- b. A description of the program including discussion on how the program reaches solution. This description must be sufficient to verify the validity of methods, assumptions, theories, and formulas, but does not require source code documentation or other information that would compromise the propriety rights.

- c. A benchmark run validating the program that includes both a computer analysis and a hand analysis of a typical or representative problem.

#### 2.12.2.3 District Approved Computer Programs

- a. RAM Structural System (Bentley)
- b. STAAD.Pro (Bentley)
- c. SAP2000 (Computers and Structures, Inc.)
- d. ETABS (Computers and Structures, Inc.)
- e. RISA 3-D (Risa Technologies)
- f. GTSTRUDL (Georgia Tech CASE Center)
- g. ENERCALC (ENERCALC, Inc.)
- h. FrameWorks Plus (Intergraph)

2.13 **REQUIREMENTS FOR DESIGN/BUILD RFP PACKAGES:** To be furnished with Specific Instructions (prepared by SAS) for the contract or delivery order and shall comply with this chapter as modified by the Specific Instructions.

#### 2.14 **TECHNICAL DESIGN REQUIREMENTS**

##### 2.14.1 General Structural Requirements

2.14.1.1 Governing Code: All structures shall be designed in accordance with IBC as modified by UFC 1-200-01. UFC 3-301-01, "Structural Engineering," will be referred to henceforth in this section because it is the document that UFC 1-200-01 delegates to for structural modifications to the IBC.

2.14.1.2 Future Expansion: Where future expansion of buildings or facilities is planned, provisions for the later expansion shall be shown on the drawings. Design assumptions for expansion shall be noted on plans.

2.14.1.3 Structural Details: Structural details will be shown on the structural plans and not intermixed with architectural plans and details.

2.14.1.4 Support of Nonstructural Items: In addition to performing the design of the structural features, the structural engineer shall be responsible for ensuring that all mechanical and electrical equipment is properly supported and that all architectural features are adequately framed and connected in accordance with IBC provisions.

2.14.1.5 Components and Cladding (C&C) Diagram: The C&C wind zones for walls and roofs will be shown on an isometric or 2D view of the building on one of the structural drawing sheets and shall be accompanied by a table that identifies the C&C pressures for each zone.

Pressures and zones for arched and gable roof, overhangs, parapets, and any other unique features shall be similarly shown.

2.14.2 Design Loads: Load assumptions shall be in accordance with IBC as modified by UFC 3-301-01.

2.14.2.1 Wind Load Criteria: Wind loads shall be in accordance with the IBC as modified by UFC 3-301-01.

2.14.2.1.2 Velocity: The wind velocity will be in accordance with UFC 3-301-01. Wind Exposure Category C shall be used unless Exposure D terrain requirements are present.

2.14.2.2 Seismic Load Criteria

2.14.2.2.1 Spectral Acceleration Values: The seismic spectral accelerations shall be in accordance with UFC 3-301-01.

2.14.2.2.2 Bridges: Seismic criteria to be used for bridges shall be as set forth in the Standard Specification for Highway Bridges, American Association of State Highway and Transportation Officials (AASHTO).

2.14.2.2.3 All Other Structures: Seismic criteria to be used for structures other than bridges shall be in accordance with IBC as modified by UFC 3-301-01.

2.14.2.3 Mechanical Loads: Roof systems over mechanical equipment rooms from which equipment or piping will be supported and roofs of HVAC plants, pump stations, etc., shall be designed for the equipment to be supported but not less than 60 PSF (2.9 kN/m<sup>2</sup>). Steel beams are the preferred framing members over these areas since they are not as sensitive to hanger attachment locations as are steel joists. Joists may be used over small mechanical rooms if suspended ceiling loads will not produce hanger loads in excess of 50 pounds (25 Kg) per hanger. Joists will not be used in HVAC plants, pump stations, or similar locations. Joists shall be reinforced or designed for specific loads over 50 pounds.

2.14.2.4 Anti-terrorism/Force Protection (ATFP): ATFP systems must be included and shall conform to UFC 4-010-01, "DoD Minimum Antiterrorism Standards for Buildings." Additional guidance may be found in UFC 4-023-03, "Design of Buildings to Resist Progressive Collapse."

2.14.3 Structural Steel: Structural steel shall be designed in accordance with IBC as modified by UFC 3-301-01.

2.14.4 Steel Joists: Steel joists shall be designed in accordance with IBC as modified by UFC 3-301-01. Joist depth and loading requirements shall be provided in the structural notes and drawings. Joist camber requirements shall be coordinated with architectural roof finishes.

2.14.5 Concrete Design: Concrete shall be designed in accordance with IBC as modified by UFC 3-301-01. 4000 psi (minimum) concrete shall be used for all structural concrete unless noted otherwise.

2.14.6 Standing Seam Metal Roof (SSMR): Standing seam metal roofs shall be structural SSMR with concealed clips. Architectural SSMR shall not be used. Concealed clips shall not be fastened through rigid insulation to the structure below. If rigid insulation is provided between metal roofing and deck below, sub-purlins shall be provided.

#### 2.14.7 Concrete Masonry

2.14.7.1 Concrete Masonry Design: Concrete masonry shall be designed using approved wall types in accordance with IBC as modified by UFC 3-301-01.

2.14.7.2 Drawings: At a minimum, the following items shall be included in the drawings to properly describe the concrete masonry elements:

- a. Wall elevations showing both horizontal and vertical reinforcing patterns for typical walls and typical openings.
- b. Details for bond beams.
- c. Lintels for all openings in masonry walls, including windows, doors, and mechanical work such as ducts.
- d. A table of special inspections required for concrete masonry elements in accordance with IBC as modified by UFC 3-301-01.

2.14.7.3 Efflorescence: Concrete masonry that has a tendency to display efflorescence shall not be used in exterior applications.

2.14.7.4 Specification Coordination: Concrete masonry specifications shall be reviewed by the structural engineer and the paragraphs of structural responsibility appropriately edited to include retaining or deleting testing of mortar and prisms. Testing requirements shall be based on the assumptions used for design and unnecessary tests will be deleted.

2.14.7.5 Mortar: Type N or S mortar will typically be used. One type of mortar is typically used for all wall types on a project.

2.14.7.6 Interior Masonry Partitions: Interior partitions must be supported at the top of the wall by adequate means such as angle braces to the roof system where they do not receive adequate lateral support from cross walls or columns, or where the walls are broken by control joints such that horizontal loads cannot be transferred longitudinally. Interior partitions which can be exposed to wind forces due to the opening of large doors shall be designed as exterior walls. Minimum seismic provisions apply to both interior partitions and to exterior walls. The design analysis shall indicate where it was necessary to design interior partitions as exterior walls.

2.14.7.7 Openings in Walls: Where walls span horizontally between columns, the lintel over the opening must be extended to the columns, and a bond beam below the opening must be extended to the columns. Steel girts may be used for this purpose if necessary. Vertical reinforcing in concrete filled cells will be used to take wind loads at large openings or to act as pilasters where heavy lintels or beams bear on the walls.

2.14.7.8 Steel Beams Bearing on Masonry Walls: Steel beams which bear on masonry walls should have slip plates and slotted holes at anchor bolts to provide for thermal movement.

2.14.7.9 Control Joints: Control joint spacing shall not be greater than recommended by the masonry associations. Joints at the normal spacing must be coordinated with additional joints required at the following locations:

- a. At corners and intersections of exterior walls and partitions where roof framing would impose horizontal loads to the top of the wall if the framing was subjected to a change of length due to change in temperature.
- b. At all bond beam breaks.
- c. At all large openings (10 ft or more in width or height).
- d. At change in wall thickness or wall heights.

2.14.7.10 Brick Expansion Joints: Location of brick expansion joints is typically shown in plan and detail on the architectural drawings. Their locations should be coordinated with the structural engineer. The location of brick expansion joints and masonry control joints do not have to coincide.

2.14.7.11 Bond Beams: Bond beams shall be placed at floor and roof level of all masonry walls. Intermediate bond beam spacing between floor levels shall be in accordance with IBC, as shall minimum and maximum reinforcing in bond beams. Reinforcement in bond beams shall be continuous through control joints at all floor and roof levels.

2.14.7.12 Miscellaneous: the following miscellaneous criteria must be met for concrete masonry:

- a. Masonry must be set  $\frac{3}{4}$  inch (20 mm) clear of all steel columns and  $\frac{3}{4}$  inch (20 mm) clear from the bottom flange of steel roof beams.
- b. Lintels will be provided over all masonry openings, and slip joints will be used under lintel bearings when a control joint is located within 2 feet (600 mm) of a masonry opening.
- c. If masonry is used within a rigid frame, the frame drift must be less than the allowable deflection of the masonry wall as defined in IBC.
- d. All lintels shall be designed in accordance with IBC.
- e. For masonry walls used as stair and elevator shafts, all cells shall be grout filled solid.

2.14.8 Timber Trusses: Timber trusses and trussed joists shall be designed and detailed on the structural drawings. Since connections for the truss members frequently employ proprietary type plates, the connection design shall be specified to be accomplished by the joist/truss fabricator and submitted for review by the Engineer of Record. The drawings prepared by the Engineer shall include member sizes and stress diagrams which indicate the maximum member

forces for which the connections are to be designed. Support anchorage shall be specified and detailed by the Engineer on the structural drawings. Under certain circumstances, and with the prior approval of the Structural Section, the Engineer may delegate the design of the wood trusses to a truss design fabricator. In this case, the truss details and framing plans prepared by the Engineer shall number each truss, show its general configuration, and shall list the technical requirements and loading. The truss design fabricator shall then prepare the complete design of the truss and shall submit the design and design calculations to the Engineer for approval as part of the shop drawings.

#### 2.14.9 Foundation Design

2.14.9.1 Concrete: All concrete building foundations should be designed in accordance with IBC as modified by UFC 3-301-01.

2.14.9.2 Foundation Type and Allowable Soil Bearing: The type of foundation, allowable bearing value, and foundation depth will be furnished by the Savannah District Soils Section (EN-GS) or the Design/Build Contractor's Geotechnical Engineer.

2.14.9.3 Foundation Notes: Foundation notes similar to those shown in Exhibit A-2-2 shall be included in the drawings.

#### 2.14.10 Building Slab-on-Grade Design

2.14.10.1 Design: Slab-on-grade design shall be in accordance with UFC 3-301-01 and ACI 360R as modified by UFC 3-320-06A.

2.14.10.2 Forklift and Vehicular Loads: Slabs-on-grade subject to forklift and/or vehicular loads shall have the loading described in the general notes. For such slabs-on-grade, the minimum concrete strength shall be 4,000 psi even if it is reinforced in order to achieve a durable wearing surface. Use a floor hardener if applicable.

#### 2.14.10.3 Slab-on-Grade Criteria

- a. Floor joints (contraction, construction, expansion) must always be shown on the structural drawings.
- b. Use a vapor barrier under all slabs on grade for buildings sensitive to moisture.
- c. Use 4 inches (100 mm) gravel capillary water barrier under all building slabs on grade when directed by the soil report.
- d. Use #30 felt between floor slabs on grade and foundation walls, beams, and piers.
- e. Slabs on grade shall not bear on grade beams, walls, or piers except where provision is made to reinforce the slab to prevent cracking should soil settlement beneath the slab occur.
- f. Refer to Exhibit A-2-2 for sample general notes for slab-on-grade.

- g. Rebar or welded wire fabric (provided in sheets, not rolls) may be used. Support spacing of welded wire fabric shall be specified on the drawings or in the specifications. Where columns occur, floor control joints should be placed on column centerlines.
- h. Slabs on grade with perimeter felt joints and with floor drains, such as in mechanical rooms, will have a rubber joint sealant on top of the felt joint.
- i. In wash rack areas, joints should be minimized by use of more reinforcement. The joint between slab on grade and foundation should have a rubber joint sealant.
- j. Topping over concrete slabs must be avoided where possible. Where it is not possible, it should be a minimum of 2 inches (50 mm) thick and reinforced with 0.1 percent reinforcement in bars or mesh in flat sheets. Fiber reinforcement may also be provided in accordance with manufacturer's instructions.
- k. Use of expansive cement and minimization of joints may be considered where economical. Where used, it should be at the Contractor's option.

#### 2.14.11 Building Frame Design Considerations

2.14.11.1 Load-Bearing Walls Versus Frame Type Buildings: Some type of building frame usually is required where a building length or length between shear walls is more than three times its width, where long clear spans are required [30 m (100 feet) or more], or where the building one-story height is in excess of 5.5 m (18 feet). Provide expansion joints through building frame at 300-foot (90 m) o.c., maximum. A comparative cost estimate should accompany concept plans to show the basis for frame selection.

2.14.11.2 Concrete Building Frames: Use Grade 60 steel reinforcing bars. Light-weight concrete may be used for floor framing but not for columns; 5000 psi (35 MPa) concrete may be used where economical; 4000 psi (27.5 MPa) concrete is normally used for pan joist floors. Types of concrete floors which have proved economical are flat slab, waffle slab, pan joist and precast concrete joists. Design dead loads should include the additional concrete topping required due to precast joist camber. Reinforcing in pan joist slabs should be bars or mesh in flat sheets. Minimum reinforcing should be 0.18 percent in each direction for mesh, or 0.2 percent for bars in a direction at right angles to joists, but bar spacing must not be greater than 3t. Bars must also be tied with cross bars at 18-inch (450 mm) o.c. maximum. Thickness of pan joist slab shall be 2-1/2 inch (65 mm) minimum.

2.14.11.3 Steel Building Frames: In general, shop welded, field bolted construction should be used, except that hanger straps supporting cranes or monorails shall be high strength bolted. High strength bolts for field connections may be used where economy or ease of construction dictates. ASTM A992 steel should be used for wide flange shapes. Bar joists should be K series as defined by the Steel Joist Institute. Long-span joists may be used where required by span and load. Specify standard joists where possible. The attached structural steel framing notes (Exhibit A-2-2) should be used where applicable. Steel columns must be clear of masonry walls. Where steel members are anchored to masonry walls to provide support, care must be used to provide slotted holes to allow the wall to move relative to the steel. Specify a nondestructive test on 100 percent of all butt-welded beam or column connections.

Where steel beams are used to support the metal deck system, the spacing can be increased up to about 2.75 m (9 feet) o.c. provided the floor slab is thickened and the metal deck system is properly designed. A vibration analysis of these type floor systems is required.

2.14.11.4 Metal buildings (MB): MB systems may be used where indicated by the directive or as otherwise approved by the Structural Section. If negotiations assumed a custom designed building and a metal building is later approved for use, then the original design contract is subject to renegotiation for the reduction in architectural and structural effort. The attached notes in Exhibit A-2-2 relating to this type building should be used. The Contractor shall design the building foundation based on the reactions provided by the metal building system engineer.

Metal buildings shall be procured using Guide Specification UFGS 13 34 19, METAL BUILDING SYSTEMS. The structural drawings shall include a foundation plan which indicates an estimate of the foundation requirements for a typical pre-engineered building that will meet the project requirements. The foundation plan shall be consistent with the requirements of the Government-furnished foundation report. This plan will be supported by notes that clearly define any additional requirements required by the COE.

2.14.11.5 Basements: Usually, basement floors will be slab-on-grade construction separated from basement walls by #30 felt. Basement walls should have membrane waterproofing on the outside and under the slab with a continuous perforated tile drain around the basement where required by the soils report.

2.14.11.6 Suspended ceilings on the exterior of building over entrances: These ceilings must be designed for wind loads. Structural steel angles or light gauge framing instead of wire hangers are normally used here since uplift can be a problem. Ceilings (excluding acoustic ceiling tile systems unless specifically engineered accordingly) may be considered as support for metal stud partitions.

#### 2.14.12 Seismic Design Considerations

2.14.12.1 The basic seismic technical requirements shall be in accordance with IBC as modified by UFC 1-200-01.

2.14.12.2 The following is a list of exceptions and clarifications to the references:

- a. Avoid use of tie rods for bracing. Use structural rolled shapes.
- b. Precast concrete, prestressed concrete, and flat slabs do not qualify as components of ductile moment resisting elements.
- c. Metal Buildings. Panels thinner than 22 gauge (0.75 mm) with self-tapping screws are not permitted for diaphragms or shear walls. All roof or wall systems using siding or roofing as a diaphragm must be tested for in-plane loading for diaphragm or shear wall effects. Test reports and recommendations must be submitted for evaluation and approval. The steel deck system must have the ability to transmit diaphragm loads and is dependent upon the deck strength, stiffness, panel configuration, fastening method and condition of installation. Since approval of tests on these systems is tedious and time consuming, cross-bracing, rigid frame wind bents, or wind columns are the preferred system. Specifications for metal



buildings must require submission of load tests on metal panel walls and roof where used as a diaphragm.

- d. The allowable drift of walls, in all cases, must be considered before selecting the type of diaphragm. All story drifts must be checked so that they will be compatible with the diaphragm deflection (especially for brittle walls).
- e. The criteria for separation of buildings will apply to seismic joints for parts of buildings. Portions of a building with differing dynamic responses will be separated from each other with seismic joints. Analysis of setbacks in plan and/or elevation per IBC shall be required to preclude use of seismic joints.
- f. Connection of diaphragm to vertical-load-carrying precast elements is necessary to transmit the lateral force generated from the weights of the frame and other masses attached thereto to the diaphragm. Also, the response of the supporting element when subjected to earthquake motion must be in resonance with the diaphragm. Therefore, positive anchorage, such as mechanical fasteners, dowels, or welding as appropriate must be provided.
- g. Prestressed, precast concrete frames are not permitted to be used as semiductile frames. The capability or performance of semiductile moment resisting frames of prestressed, precast construction is questioned. Based on our knowledge, its use has not been accepted by codes. Therefore, we cannot allow its use without any specific information or design data to confirm its performance and structural adequacy.
- h. Buildings with basements or buried structures may be required to be analyzed for the effect of dynamic soil loadings.
  - i. Design analysis shall include the design of collector elements for over-strength factor as applicable by code.

2.14.12.3 Seismic vs. Wind: When comparing wind and seismic calculations the general perception that wind or seismic governs totally in a particular direction is not valid. Even though wind or seismic governs a particular direction based on the overall magnitude of load in that direction does not mean that the other is ruled out when considering the design of individual elements of the building that are affected by lateral load in that direction. As will be demonstrated below, wind and seismic calculations have, for different systems and elements, different factors applied to the loads on those elements. This greatly complicates a "controlling load determination," and mandates that this determination not be made on the building as a whole, but that each element of the building must be considered separately, (i.e., parts and portions of a building are to be designed individually for the highest load on them). Both seismic and wind loads should be taken to individual elements and then only after placing the proper factors to the loads should the highest load be selected.

## 2.14.13 Miscellaneous Structures

2.14.13.1 Manholes, Pullboxes, Surface Inlets : A minimum 3000 psi (20 Mpa) compressive strength concrete will be used. Verify location of water table with Soils Section (EN-GS) and check for uplift. Standard precast concrete structures are acceptable and desired where more economical. H-15 wheel loads will be used except for structures in pavement which will be designed for the wheel load for which the pavement was designed.

2.14.13.2 Headwalls and Box Culverts: Minimum 3000 psi (20 Mpa) compressive strength concrete should be used.

2.14.13.3 Transformer Pads, Condenser Pads, and Generator Pads: Concrete should be minimum 3000 psi (20 Mpa) compressive strength.

2.14.13.4 Retaining Walls, Basement Walls: Lateral earth loads on structures should be based on  $p = whK$ ; where  $p$  = lateral pressure,  $w$  = wet unit weight of earth [120 psf (20 kN/m<sup>3</sup>) minimum, may be higher in some areas],  $h$  = depth of structure, and  $K$  is a coefficient (use 0.5 for retaining walls, 0.7 for basement walls and box culverts), and verify with Soils Section (EN-GS). Surcharge loads should be included where applicable. Investigation should also be made using 100 percent hydrostatic pressure (where applicable) at one-third overstress (50 percent where drains are used). The working stress method of design is preferred with actual loads on the wall.

2.14.13.5 Monorail Design: Monorail beams shall be designed for maximum bending stress of:

$$f = \frac{3,000,000}{1d/bt} \text{ but not greater than } 10,000 \text{ psi (69 Mpa).}$$

based on rated capacity of the hoist plus 25 percent impact and full dead loads for vertical loads, and 20 percent of rated capacity + 25 percent impact for horizontal loads. Deflections should be limited to  $L/800$ .

Beams shall also be checked for a maximum overload of 2.75 times the rated hoist capacity at 75 percent of the yield stress. An "I" beam, with channel on top, (T) section should be used for all but very short spans. The hangers and system supporting the monorail beam should be designed for the same loads but at normal stresses. Knee braces should be provided where applicable. Field connections should be A325 bolted connections.

2.14.13.6 Traveling Crane Runway Girders: Runway girders will normally be designed by the crane vendor and will be provided based on performance specifications. The following guidelines should be included in these specifications.

2.14.13.6.1 Continuous girders should not be used where significant unequal foundation settlement is likely to occur. Where foundations are other than shale or hard rock, check anticipated differential settlement so that the difference is limited to  $0.003 L$  between adjacent supports. (Simply supported girders are not ordinarily affected by differential foundation movements.)

2.14.13.6.2 Limit live load deflection at midspan to  $L/1,000$ .

2.14.13.6.3 For continuous girders, limit ratio of length of adjacent spans to 2:1.

2.14.13.6.4 Connect ends of simply supported girders in such a manner that will allow the ends to rotate under vertical loading.

2.14.13.6.5 Proprietary hanging systems by the successful bidder are preferred over direct bolted connections.

2.14.13.7 Precast Concrete Panels: Precast concrete panels used as non-load bearing construction should have connections such that thermal expansion or contraction may occur without damage to the panels. These connections should at least allow movement at one end of the panel. These connections could be in the form of studs welded to embedded steel plates and anchored into an angle with slotted holes in the direction of expected movement. Also, when the panels bear on other members such as steel or concrete, the expansion end of the panels should bear on neoprene pads, steel or some such material that will minimize the frictional resistance to movement. The precast concrete of the shearing areas should be reinforced additionally horizontally and vertically to minimize cracking of these bearing areas. Reference is made to PCI Manual for Structural Design of Architectural Precast Concrete. Seismic connections should be in accordance with IBC.

2.14.14 Fire Walls: shall be designed in accordance with current IBC provisions.

## **CHAPTER A-2**

### **STRUCTURAL**

#### **APPENDIX: EXHIBITS**

- A-2-1 Wind Velocities and Seismic Spectral Accelerations at Local Installations
- A-2-2 General Notes (For Information Only)
- A-2-3 Concept (35%) Design Brochure Outline
- A-2-4 Structural Section Quality Control Checklist for Review of A-E Final Design

## **WIND VELOCITIES AND SEISMIC SPECTRAL ACCELERATIONS AT LOCAL INSTALLATIONS**

Wind and Seismic criteria for specific locations shall be identified using the structural load data tool hosted on the Whole Building Design Guide website at <https://www.wbdg.org/additional-resources/tools/ufcsldt>.

### GENERAL NOTES (FIO)

Note: do not directly copy the sample loading criteria shown below for any project. Loading criteria must be determined independently for each project; this sample is only intended to provide a format for the information that should be included with every submittal.

1. **DESIGN LOADS:**

FLOOR LIVE LOADS:	SLABS-ON-GRADE	=	150 psf
	STAIRWELLS	=	100 psf
	CORRIDORS	=	100 psf
	CLASSROOMS & STORAGE	=	100 psf
	MECHANICAL & ELECTRICAL SPACE	=	150 psf
ROOF LIVE LOADS	ROOF	=	20 PSF
SNOW LOADS	REFERENCE: ASCE 7-16		
	RISK CATEGORY	=	II
	SNOW IMPORTANCE FACTOR, $I_s$	=	1.0
	MINIMUM GROUND SNOW LOAD	=	10 PSF
	FROST PENETRATION DEPTH	=	0 IN
	MINIMUM ROOF SNOW LOAD	=	10 PSF
	SNOW DRIFT LOADING	=	SEE SXXX
WIND LOADS:	REFERENCE: ASCE 7-16		
	RISK CATEGORY	=	II
	WIND IMPORTANCE FACTOR, $I_w$	=	1.0
	BASIC WIND SPEED, $V$ (ULTIMATE)	=	115 MPH
	BASIC WIND SPEED, $V$ (SERVICE)	=	89 MPH
	WIND EXPOSURE CATEGORY	=	C
	GUST EFFECT FACTOR, $G$	=	0.85
	INTERNAL PRESSURE COEFF	=	+/- 0.18
SEISMIC LOADS:	REFERENCE: ASCE 7-16		
	RISK CATEGORY	=	II
	SEISMIC IMPORTANCE FACTOR, $I_w$	=	1.0
	MAPPED SPECTRAL RESP ACC, $S_s$	=	0.27
	MAPPED SPECTRAL RESP ACC, $S_1$	=	0.11
	SITE CLASS	=	D
	MAPPED SPECTRAL RESP ACC, $S_{ds}$	=	0.284
	MAPPED SPECTRAL RESP ACC, $S_{d1}$	=	0.175
	SEISMIC DESIGN CATEGORY	=	C
	SEISMIC ANALYSIS PROCEDURE	=	ELF
	SEISMIC-FORCE RESISTING SYSTEM	=	OCBF
	RESPONSE MODIFICATION FACTOR, $R$	=	3.25
	SYSTEM OVERSTRENGTH FACTOR, $\Omega_0$	=	2.0
	DEFLECTION AMP FACTOR, $C_d$	=	3
	$C_s$	=	0.101
	SEISMIC BASE SHEAR	=	250 KIPS

ATFP CRITERIA:	REFERENCE: UFC 4-010-01 NEW BUILDING LOCATION	WITHIN A CONTROLLED PERIMETER
	BUILDING CATEGORY	PRIMARY GATHERING BUILDING
	DESIGN LEVEL OF PROTECTION PROGRESSIVE COLLAPSE APPLIES	LOW (LLOP) YES (>3 STORIES)

1. WHERE A SECTION OR DETAIL IS SHOWN FOR ONE CONDITION, IT SHALL APPLY TO ALL LIKE AND SIMILAR CONDITIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN AND DETAIL OF SIMPLE (SHEAR ONLY) CONNECTIONS NOT SHOWN ON THE DRAWINGS.
3. NO CORE DRILLING WILL BE PERMITTED IN THE FOUNDATION WALLS OR IN THE ELEVATED SLABS. REFER TO THE MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS TO LOCATE PENETRATIONS. THE PENETRATION LOCATIONS MUST BE SHOWN IN THE SHOP DRAWING SUBMITTALS.

#### **CONCRETE MASONRY NOTES (FIO)**

1. ALL CONCRETE MASONRY WORK SHALL CONFORM TO ACI 530.
2. ALL CMU SHALL BE TWO-CELL TYPE UNITS EXCEPT LINTELS WHICH SHALL BE U-SHAPED UNITS.
3. BOND BEAM UNITS MAY BE U-SHAPED OR TWO-CELL TYPE.
4. ALL CMU SHALL CONFORM TO ASTM C-90 OR EQUIVALENT METRIC STANDARD.
5. ALL CELLS CONTAINING REINFORCING SHALL BE FULL GROUTED.
6. USE TYPE S MORTAR WITH A MINIMUM COMPRESSIVE STRENGTH OF 1800 psi AT 28 DAYS.
7. VERTICAL CELLS TO BE FILLED SHALL HAVE VERTICAL ALIGNMENT SUFFICIENT TO MAINTAIN A CLEAR UNOBSTRUCTED CONTINUOUS VERTICAL CELL NOT LESS THAN 50 X 75mm PLAN DIMENSIONS.
8. ALL MASONRY BOND BEAMS, LINTELS, AND VERTICALLY GROUTED CELLS SHALL BE FILLED SOLIDLY WITH 2500 psi GROUT.
9. BOND BEAMS AT CMU WALLS THAT ARE PERPENDICULAR TO EACH OTHER SHALL MEET AT THE SAME ELEVATION AND THE REINFORCING SHALL BE LAPPED AS REQUIRED.
10. ALL CONCRETE MASONRY UNITS SHALL HAVE A GROSS SPECIFIED COMPRESSIVE STRENGTH OF 2000 psi AT 28 DAYS.
11. DOWELS FROM THE ATTIC SLAB SHALL BE PROVIDED. THE SPACING AND SIZE OF THE DOWELS SHALL MATCH THE VERTICAL REINFORCING BARS.

12. THE ASSUMED  $F'_m$  FOR MASONRY = 1500 psi.

### CONCRETE NOTES (FIO)

1. ALL CONCRETE WORK SHALL CONFORM TO ACI 318, BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE.
2. CONCRETE STRENGTH = 4000 psi AT 28 DAYS FOR CONCRETE MEMBERS INCLUDING FOOTINGS AND TRENCHES.
3. REINFORCING BARS SHALL CONFORM TO ASTM A615M, A184, A184M  $F_y = 60$  ksi.
4. ALL SPLICES SHALL BE CLASS "B" TENSION LAP SPLICES UNLESS NOTED OTHERWISE.
5. MINIMUM CONCRETE COVER FOR REINFORCING STEEL SHALL BE AS INDICATED BELOW. IN NO CASE SHALL REINFORCEMENT COVER BE LESS THAN THE REQUIREMENTS OF ACI 301.

CONCRETE DEPOSITED AGAINST THE GROUND	3"
CONCRETE EXPOSED TO EARTH OR WEATHER	2"
SLABS AND WALLS	1"
6. VERTICAL FOUNDATION WALL REINFORCING DOWELS SHALL EXTEND INTO THE FOUNDATION WITH HOOKED BARS OF THE SAME SIZE AND SPACING AS THE VERTICAL REINFORCING.
7. SLABS-ON-GRADE SHALL INCLUDE FIBER MESH REINFORCING AS PRESCRIBED IN THE SPECIFICATIONS TO CONTROL SHRINKAGE.
8. DURING PLACEMENT OF THE CONCRETE SLABS, ALL PRECAUTIONARY STEPS MUST BE TAKEN TO AVOID PLASTIC CRACKS DUE TO WEATHER CHANGES. THE CONTRACTOR SHALL COMPUTE THE PROJECTED RATE OF EVAPORATION IN ACCORDANCE WITH ACI 308R WITHIN 24 HOURS OF PLACEMENT. IF THE PROJECTED EVAPORATION RATE EXCEEDS THE MAXIMUM ALLOWABLE, THEN THE ERECTION OF SUNSHADES, WINDBREAKERS, AND OTHER SUCH MEASURES AS MAY BE REQUIRED MUST BE TAKEN TO MINIMIZE PLASTIC CRACK FORMATION.
9. THE BAR BENDING SCHEDULE FOR THE FOUNDATION MUST BE SUBMITTED FOR APPROVAL. THE BAR BENDING SCHEDULE SHALL CONFORM TO THE REQUIREMENTS OF ACI 318.

### FOUNDATION NOTES (FIO)

1. REFERENCE ELEVATION 100 ft IS THE ASSUMED FIRST FLOOR FINISHED ELEVATION WITHIN STRUCTURAL DRAWINGS. SEE SHEET \_\_\_\_\_ FOR ACTUAL FIRST FLOOR FINISHED ELEVATION.
2. THE ALLOWABLE SOIL BEARING PRESSURE IS \_\_\_\_\_ PSF. REFER TO THE GEOTECHNICAL REPORT DATED \_\_\_\_\_ PROVIDED BY EN-GS, SAVANNAH DISTRICT.
3. CONSTRUCTION JOINTS IN CONTINUOUS FOOTINGS ARE TO BE FORMED VERTICALLY WITH MINIMUM 24 in LAPS IN CONTINUOUS REINFORCING UNLESS NOTED OTHERWISE.
4. PLACE VAPOR BARRIER (15 MIL RECOMMENDED) AND 4 in CAPILLARY WATER BARRIER UNDER ALL SLABS-ON-GRADE (TYPICAL).



5. ALL FLOOR ISOLATION JOINTS SHALL BE No. 30 FELT.
6. FILL ALL CMU CAVITIES BELOW GRADE WITH GROUT.
7. THE ALLOWABLE SOIL BEARING CAPACITY IS \_\_\_\_ psf.

### **BUILDING SLAB ON GRADE NOTES (FIO)**

1. CONCRETE FLOOR SLAB-ON-GRADE MAY BE PLACED IN EITHER CHECKERBOARD PATTERN OR IN LANES. SPACING OF JOINTS SHALL BE AS SHOWN ON THE FOUNDATION PLAN. IF CHECKERBOARD PATTERN IS USED, ALL JOINTS SHALL BE CONSTRUCTION JOINTS. IF LANE PLACEMENT IS USED, CONSTRUCTION JOINTS SHALL BE USED FOR THE JOINTS BETWEEN LANES, WHILE WEAKENED PLANE JOINTS SHALL BE USED DOWN EACH LANE. THE REINFORCING IN THE SLAB SHALL BE \_\_\_\_\_.

### **STRUCTURAL STEEL NOTES (FIO)**

1. ALL STRUCTURAL STEEL WORK SHALL CONFORM TO THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC) SPECIFICATIONS FOR DESIGN, FABRICATION, AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS. THE SIZES OF STRUCTURAL MEMBERS SHALL BE GOVERNED BY ASTM A6/M.
2. CONNECTIONS - GENERAL:
3. ALL CONNECTIONS NOT DETAILED OR OTHERWISE NOTED SHALL BE DESIGNED AS AISC TYPE 2 BOLTED CONNECTIONS DESIGNED FOR THE FULL LOAD CAPACITY OF THE CONNECTING MEMBERS UNLESS NOTED OTHERWISE.
4. THE DESIGN AND DETAILING OF ALL CONNECTIONS SHALL CONFORM TO THE AISC SPECIFICATION CONTAINED IN AISC-9.
5. MATERIAL SPECIFICATION FOR ROLLED SECTIONS STRUCTURAL STEEL SHALL CONFORM TO ASTM A992 (GRADE 50), UNLESS NOTED OTHERWISE. HSS STEEL SECTIONS SHALL CONFORM TO ASTM A500 (GRADE C). PLATE AND OTHER SHAPES (ANGLES, CHANNELS, ETC) SHALL CONFORM TO ASTM A36.
6. MINIMUM WELD SIZE FOR STRUCTURAL STEEL CONNECTIONS IS  $\frac{3}{16}$  in FILLET, UNLESS NOTED OTHERWISE.
7. STEEL ROOF DECK TO BE MINIMUM DIMENSION OF 1.5 in DEEP AND 0.0379 in THICK (20 GAUGE). THE DIMENSIONS SHOWN IN THE DRAWINGS FOR STRUCTURAL STEEL BEAMS, COLUMNS, PLATES, RODS, METAL DECK, AND SCREWS ARE NOMINAL DIMENSIONS.
8. THIS STRUCTURE IS CONSIDERED A NON-SELF-SUPPORTING BRACED FRAME. THE CONTRACTOR SHALL PROVIDE ADEQUATE TEMPORARY SUPPORTS UNTIL ALL PERMANENT BRACING AND FLOOR SLABS ARE IN PLACE.

### **LIGHT GAUGE TRUSS AND FRAMING NOTES (FIO)**

1. ROOF LAYOUT AND COMPONENTS SHOWN ON THE DRAWINGS ARE FOR GENERAL CONFIGURATION ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DIMENSIONS, ELEVATIONS CONNECTION DETAILS, QUANTITIES, ETC. NECESSARY FOR THE COMPLETE DESIGN, FABRICATION, AND ERECTION OF THE METAL ROOF FRAMING SYSTEM. THE CONTRACTOR SHALL COORDINATE THE DESIGN WITH THE ARCHITECTURAL PLANS, ELEVATIONS, AND DETAILS.
2. LIGHT GAUGE TRUSS AND FRAMING MEMBERS SHALL BE DESIGNED IN ACCORDANCE WITH THE AMERICAN IRON AND STEEL INSTITUTE (AISI) SPECIFICATION FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS.
3. ALL CALCULATIONS AND DRAWINGS USED IN THIS DESIGN MUST BE SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF GEORGIA AND SUBMITTED TO THE GOVERNMENT FOR APPROVAL. IN ADDITION TO THE CALCULATIONS, THIS SUBMITTAL SHALL INCLUDE DETAILS OF CONNECTIONS, ERECTION PLAN, LAYOUT, OUTRIGGERS, HEADERS, BRIDGING, AND BOTH TEMPORARY AND PERMANENT BRACING.
4. THE CONTRACTOR SHALL SUBMIT COMPLETE PRODUCT CATALOGS FROM THE TRUSS MANUFACTURER FOR REVIEW PRIOR TO FABRICATION. THE CATALOGS SHALL INDICATE QUALIFICATIONS, MATERIAL SPECIFICATIONS, DESIGN REFERENCES, ETC.
5. ALL COLD-FORMED STEEL MEMBERS, THEIR COMPONENTS, AND CONNECTION MATERIAL SHALL BE HOT-DIPPED GALVANIZED.
6. ALL TOP CHORD MEMBERS SHALL HAVE A MINIMUM THICKNESS OF 16 GAUGE (OR 54 MIL).

### **METAL BUILDING SYSTEMS NOTES (FIO)**

1. BUILDING SHALL BE A METAL BUILDING AS SPECIFIED IN SECTION UFGS 13 34 19, METAL BUILDING SYSTEMS. THE BUILDING SHALL BE A MANUFACTURER'S STANDARD PREFABRICATED METAL STRUCTURE OF THE APPROXIMATE INSIDE AREA SHOWN, EXCEPT AS NOTED. RIGID FRAMES SHALL BE SPACED AT CENTER TO CENTER, BUT OVERALL DIMENSIONS AND CONSTRUCTION DETAILS MAY VARY TO SUIT MANUFACTURER'S STANDARD DESIGN.
2. THE BUILDING SHALL BE DESIGNED AND FABRICATED ACCORDING TO AISC AND AISI LATEST SPECIFICATIONS. THE DIMENSIONAL TOLERANCES OUTLINED IN THE AWS CODE UNDER WORKMANSHIP AND THE TOLERANCES APPLICABLE TO ROLL FORM STEEL UNDER THE AISC "STANDARD MILL PRACTICE" SECTION SHALL BE REQUIRED IN THE FABRICATION OF THE STEEL BUILDING FRAMES.
3. A COMPLETE DESIGN ANALYSIS SHOWING ALL CALCULATIONS FOR THE RIGID FRAMES, GIRTS, AND PURLINS, AND A LAYOUT OF ANCHOR BOLTS AND OTHER EMBEDDED ITEMS SHALL BE SUBMITTED FOR APPROVAL WITH THE SHOP DRAWINGS. SHOP DRAWINGS SHALL INCLUDE DETAILS OF ALL MAIN MEMBERS, TYPICAL CONNECTIONS (SHOWING BOLT HOLES AND WELDS), AND ERECTION DRAWINGS.

4. THE BUILDING SHALL BE DESIGNED TO SUPPORT ALL MECHANICAL EQUIPMENT INCLUDING HEATERS, SPRINKLERS, EXHAUST SYSTEMS, AND ALL OTHER SUCH DEVICES. ADDITIONAL GIRTS OR PURLINS SHALL BE PLACED IN CONVENIENT LOCATIONS FOR ATTACHMENT OF ALL MECHANICAL EQUIPMENT.
5. WIND LOADS, LIVE LOADS AND LOAD COMBINATIONS SHALL BE IN ACCORDANCE WITH UFC 3-310-01, "DESIGN LOAD ASSUMPTIONS FOR BUILDINGS."
6. CROSS BRACING SHALL BE USED TO TAKE LATERAL LOADS.
7. THE FOUNDATIONS SHOWN ARE ESTIMATES FOR THE BUILDING TYPE SHOWN ON THE DRAWINGS AND ARE TO BE USED AS A GUIDE FOR THE BUILDING SUPPLIED. THE CONTRACTOR SHALL DESIGN THE FOUNDATIONS FOR THE LOADS SHOWN AND THE BUILDING SUPPLIED.
8. THE CONTRACTOR SHALL USE IN THEIR DESIGN THE BASIC CRITERIA SHOWN BY THIS DRAWING, SUCH AS SLAB THICKNESS, CONTROL JOINTS, CAPILLARY WATER BARRIER, VAPOR BARRIER, DESIGN LOADS, AND MINIMUM DEPTH OF FOOTING.
9. FOOTINGS SHALL BE SIZED FOR AN ALLOWABLE SOIL BEARING VALUE OF \_\_\_\_ PSF. THIS VALUE IS BASED ON A MINIMUM FOOTING WIDTH OF FEET AND A MINIMUM DEPTH OF FEET TO THE BASE OF THE FOOTING MEASURED FROM FINISH FLOOR OR FINISH GRADE ELEVATION, WHICHEVER IS LOWER.
10. FOUNDATION DESIGN SHALL BE PERFORMED BY A REGISTERED PROFESSIONAL ENGINEER AND SHALL BE SUBMITTED FOR APPROVAL WITH AND AS PART OF THE SHOP DRAWINGS. FOUNDATION DESIGN DRAWINGS SHALL BE SEALED BY THE FOUNDATION ENGINEER OF RECORD.

## ABBREVIATIONS (FIO)

ACI	AMERICAN CONCRETE INSTITUTE
AFF	ABOVE FINISHED FLOOR
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
BRG	BEARING
CMU	CONCRETE MASONRY UNIT
CONC.	CONCRETE
CONT.	CONTINUOUS
C.J.	CONSTRUCTION JOINT
DIA.	DIAMETER
EL.	ELEVATION
EW	EACH WAY
FIN.	FINISHED
HORIZ.	HORIZONTAL, HORIZONTALLY
IN <sup>3</sup>	INCHES CUBED
IN <sup>4</sup>	INCHES TO THE FOURTH POWER
LLV	LONG LEG VERTICAL
MAX.	MAXIMUM
MIN.	MINIMUM
No.	NUMBER
o.c.	ON CENTER
OPP.	OPPOSITE
Pa	PASCAL
KPa	KILOPASCAL
PEJ	PREMOLDED EXPANSION JOINT
REINF.	REINFORCING
SIM.	SIMILAR
SLV	SHORT LEG VERTICAL
TOS	TOP OF STEEL
TYP.	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT.	VERTICAL
w/	WITH
X	BY
WP	WORK POINT
L	ANGLE

## CONCEPT (35%) DESIGN BROCHURE OUTLINE

### 1. Structural Narrative

- a. General
- b. Framing System
- c. Foundation
- d. Special Design Features
- e. Fire Resistance Statement
- f. List structural information needed to complete final design.

### 2. Structural Design Analysis

#### a. Load Assumptions

- 1) Dead Loads (provide references)
- 2) Live Loads
  - Roof \_\_\_\_\_ psf
  - Floor \_\_\_\_\_ psf
- 3) Snow Load
  - Ground Snow Load \_\_\_\_\_psf
- 4) Wind Load
  - Velocity \_\_\_\_\_ mph
  - Exposure \_\_\_\_\_
  - Importance \_\_\_\_\_
- 5) Seismic Load
  - Seismic Force Resisting System:  
Steel Systems Not Specifically Detailed For Seismic Resistance

Ss	_____ g	Sds	_____ g
S1	_____ g	Sd1	_____ g
Importance	_____	R	_____
Site Class	_____	$\Omega_o$	_____
Fa	_____	C <sub>d</sub>	_____
Fv	_____	C <sub>s</sub>	_____
- 6) Crane Load
- 7) ATFP/Progressive Collapse

#### b. Material Strengths

- 1) Concrete  $f'_c$  4,000 psi
- 2) Reinforcing Steel  $F_y$  60,000 psi
- 3) Structural Steel  $F_y$  50,000 psi
- 4) Other as appropriate

#### c. Calculations: per section 2.5.2.3, SDDM Volume II

### 3. Comparative Structural System Selection Analysis: per section 2.5.3, SDDM Volume II

### 4. Concept/Early Preliminary Drawings: per section 2.5.4, SDDM Volume II

5. Outline Specifications: per section 2.5.5, SDDM Volume II
6. Specific Instructions: per section 2.5.6, SDDM Volume II

**STRUCTURAL SECTION**  
**QUALITY CONTROL CHECKLIST**

**FOR REVIEW OF A-E AND IN-HOUSE FINAL DESIGNS**

<b>Project Title:</b>	<b>Date:</b>
<b>Designed by:</b>	<b>Checked by:</b>
<b>GENERAL</b>	
1. Before beginning the review, check to see that you have a complete package, check A-E Standard Procedures manual and the Specific Instructions (prepared by SAS) to see if everything required was furnished. If anything is missing, see the Work Load Manager before proceeding.	<input type="checkbox"/>
2. Before beginning the review, scan the directive, 1391, instructions, prior review comments, and correspondence.	<input type="checkbox"/>
3. After beginning the review, if it appears that the submittal is unsatisfactory, do not proceed. Notify the Work Load Manager.	<input type="checkbox"/>
<b>SPECIFICATION CHECK</b>	
4. Verify that the required sections of the specifications are in the job by comparing the specification index to the plans.	<input type="checkbox"/>
5. Verify that the specifications have been properly edited for the project by reviewing the marked-up sections.	<input type="checkbox"/>
6. Verify that the appropriate review level is indicated for all submittals.	<input type="checkbox"/>
7. Check UFGS 04 20 00, MASONRY structural items to ensure specification is coordinated with the design. Especially check the testing and/or reinforcing requirements to verify that they are appropriate.	<input type="checkbox"/>
8. Cross check other section's specifications to ensure that any included structural information is correct, i.e., UFGS 13 34 19, METAL BUILDING SYSTEMS for pre-engineered structures, UFGS 13 48 00, SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT for seismic, etc.	<input type="checkbox"/>
<b>DESIGN CHECK</b>	
9. Verify that the design analysis has been signed by both the designer and the checker.	<input type="checkbox"/>
10. Verify that the live loads are in accordance with criteria, particularly over mechanical rooms.	<input type="checkbox"/>

11.	Verify that the wind loads are correctly computed and applied.	<input type="checkbox"/>
12.	Verify that the seismic loads are correctly calculated and applied.	<input type="checkbox"/>
13.	Verify the appropriateness of the seismic design assumptions and details such as building separation, etc.	<input type="checkbox"/>
14.	Verify the design of the major structural elements, i.e. columns, girders, beams, walls, etc., by spot checking the design of at least one member in each category. Investigate additional members depending upon the results of the initial spot check.	<input type="checkbox"/>
15.	Verify the design of the lateral load resisting system from the roof diaphragm to the foundation.	<input type="checkbox"/>
16.	Verify that the assumptions used in the foundation analysis are consistent with the foundation report.	<input type="checkbox"/>
17.	Verify the adequacy of the foundation design by spot checking the design of a least one type of each foundation element used.	<input type="checkbox"/>
18.	If computer programs are used, verify that the necessary backup material has been provided and the assumptions within the backup material are appropriate.	<input type="checkbox"/>
<b>DRAWING CHECK</b>		
<b>19.</b>	<b>General Notes:</b>	
a)	Verify that ALL design loads are indicated, i.e., live, wind, seismic, crane, etc.	<input type="checkbox"/>
b)	Verify that the strength of materials used is specified, i.e., A992 steel, 3,000 psi concrete, Grade 60 reinforcing, f'm 1,350 psi compressive strength masonry.	<input type="checkbox"/>
c)	Verify that the type of mortar to be used for masonry walls is specified and matches the specifications.	<input type="checkbox"/>
d)	Verify that concrete reinforcing requirements such as grade of reinforcing and splice lengths are given (i.e., Grade 60 and 40 bar diameters, respectively).	<input type="checkbox"/>
e)	Verify that slab-on-grade thickness and reinforcing requirements are given.	<input type="checkbox"/>
f)	Verify that slab-on-grade notes similar to those shown on Exhibit A-2-2 are provided.	<input type="checkbox"/>
g)	Verify notes are provided for attachment of metal deck diaphragms to supporting members.	<input type="checkbox"/>
h)	Verify that notes are provided for details on any design element not otherwise	<input type="checkbox"/>



shown on the drawings.	
<b>20. Metal Building Notes:</b> Verify that notes similar to those shown on exhibit A-2-2 are used. Also ensure that the same design philosophy indicated on the notes is used in the design.	<input type="checkbox"/>
<b>21. Foundation Notes:</b>	
a) Verify that the allowable soil bearing value and depth required to develop this value are shown.	<input type="checkbox"/>
b) Verify that any other soil design data for designing retaining structures is shown.	<input type="checkbox"/>
c) Verify that appropriate bracing or shoring notes are provided.	<input type="checkbox"/>
d) Verify that any special foundation conditions or requirements are described in the notes.	<input type="checkbox"/>
<b>22. Superstructure Notes:</b>	
a) Verify that the strength of all materials used is indicated here or in the general notes.	<input type="checkbox"/>
b) Verify that the appropriate type of connections is specified, i.e., type/grade of bolts, welds with electrode types, minimum size of fillet welds where not indicated.	<input type="checkbox"/>
c) Verify that the minimum S, I, and weld requirements are given for all metal decks to include rib type (narrow, intermediate, or wide).	<input type="checkbox"/>
d) Verify that a note is added prohibiting the application of loads greater than 50 pounds (22.7 kg) to steel joists without the use of the joist strengthening detail.	<input type="checkbox"/>
e) Verify that an appropriate amount of draw is indicated for all X-bracing.	<input type="checkbox"/>
23. Verify that all depressed or raised slabs are indicated.	<input type="checkbox"/>
24. Verify that proper sizes are indicated on the drawings for structural elements by a spot check comparison of member sizes shown in the calculations and on the drawings. Include at least one type of each structural member in the spot check.	<input type="checkbox"/>
25. Verify that the drawing notes do not conflict with the specifications.	<input type="checkbox"/>
26. Verify that the slab elevations are shown and agree with architectural and site plans.	<input type="checkbox"/>
27. Verify that top-of-steel, top-of-wall bearing, etc. elevations are clearly indicated.	<input type="checkbox"/>

28.	Verify that sufficient sections are cut on the plans to indicate clearly the details of construction. Verify that section cuts are properly oriented and properly referenced. Spot-check as required.	<input type="checkbox"/>
29.	Verify by scanning all sections and details that no criteria violations are present, i.e., slabs resting on footings, etc.	<input type="checkbox"/>
30.	Check slab-on-grade jointing to verify compliance with criteria.	<input type="checkbox"/>
31.	Verify that stress diagrams are provided for all trusses.	<input type="checkbox"/>
32.	Verify that waterproofing is properly shown where required by the soils report.	<input type="checkbox"/>
33.	Verify that Plate S-1 has been initialed by both the designer and checker.	<input type="checkbox"/>
34.	Verify that appropriate details and notes are provided to indicate CMU reinforcing, thickness, and lintel requirements. Interior walls must be designed to span horizontal or vertical under a 10 psf (48.8 kg/m <sup>2</sup> ) lateral load. Verify that vertical spanning walls are properly supported at the top.	<input type="checkbox"/>
35.	Verify that minimum seismic reinforcement is provided in masonry walls if required. Verify that cavity walls are properly designed and have the appropriate reinforcement, i.e., bond beams shown, joint reinforcing 3/16 diameter for seismic walls, etc.	<input type="checkbox"/>
36.	Verify that masonry walls are properly jointed and that reinforcement is not continuous through joints except at floor and roof levels. Locations to be shown on the "S" drawings and "A" drawings with appropriate details.	<input type="checkbox"/>
37.	Verify that moment connections are either detailed or that the plans indicate the moment for which the joint is to be designed.	<input type="checkbox"/>
38.	Determine if the following items are required and delete them from the specifications as appropriate: capillary water barrier, floor hardener, waterproofing, floor slab reinforcing (increase joint spacing and use 4,000 psi concrete if omitted), flexural strength concrete (pavement only).	<input type="checkbox"/>
39.	Verify that a roof slope greater than 1/4" (6 mm — Army) and 1/4" (6 mm — Air Force) is provided.	<input type="checkbox"/>
40.	Verify that the minimum depth of the footings agrees with the soils report.	<input type="checkbox"/>
41.	Verify that the structural details of vaults, arms rooms and secure areas meet criteria requirements.	<input type="checkbox"/>
42.	Verify that perimeter insulation is shown along exterior walls under slabs-on-grade for all air-conditioned spaces. It should be specified in section UFGS 03 30 00, CAST-IN-PLACE CONCRETE or 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE and shown on all "S" plate and "A" plate wall sections.	<input type="checkbox"/>

43.	Verify all cells of CMU walls below grade are filled with grout.	<input type="checkbox"/>
44.	Verify that drawings clearly indicate which buildings, by name, are to be constructed using specification UFGS 13 34 19, METAL BUILDING SYSTEMS.	<input type="checkbox"/>
45.	Verify coordination of mechanical and electrical equipment for support details on the "S" drawings.	<input type="checkbox"/>
46.	Check for details when pipes through exterior foundation walls.	<input type="checkbox"/>

\*\*\* End of Section \*\*\*

**CHAPTER A-3**  
**ARCHITECTURAL**

Revised July 2020

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## CHAPTER A-3

### ARCHITECTURAL

#### 3.1 GENERAL

3.1.1 Scope. This chapter states criteria, requirements and guidance for architectural design. Specific submittal requirements in this chapter supplement the requirements of Volume 1.

3.1.2 Architectural Quality. The objective of the Savannah District is to obtain attractive facilities that are designed using sound technical knowledge and constructed using recognized, good industry practices, as well as being cost effective. The design and construction shall incorporate those characteristics which will provide facilities with present and continuing utility, durability and desirability, and which will be economical to maintain for the life of the structure. The design shall also be such as to provide a safe and healthy environment. All projects shall comply with UFC 1-200-01, UFC 3-101-01, UFC 3-110-03 and UFC 3-600-01. Air Force projects shall comply with Air Force Corporate Facilities Standards (AFCFS). DoDEA projects shall comply with DoDEA 21<sup>st</sup> Century Education Facilities Specifications and DoDEA Facilities Management Guides.

3.1.3 Sustainable Design. The Department of Defense has a policy to support the design, construction, operation and reuse/removal of the built environment (infrastructure and buildings) in an environmentally and energy efficient manner. Architectural contributions include building envelope characteristics, solar control and day lighting, views, indoor air quality, environmentally preferable materials selections, salvage/reuse opportunities, waste reduction and close collaboration with all team members and User to synthesize successful sustainable design solutions. Chapter 14, Sustainable Design, contains detailed requirements. All projects shall comply with UFC 1-200-02.

3.1.3.1 Energy Conservation Study. Economic studies to evaluate the use of passive solar design techniques (building orientation, amount and location of windows, etc.) will be in accordance with Chapter A-7 ENERGY ANALYSIS.

3.1.4 Antiterrorism/Force Protection. All facilities must be designed in accordance with UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings.

3.1.5 Multiple Buildings. Unless directed otherwise, when a project includes multiple buildings, drawings shall be sequenced so that each building has a separate stand-alone set of drawings. If floor plans are mirror images of other buildings, the drawing shall actually be copied and a separate standalone set of drawings created.

3.1.6 Site Adapting. When site adapting standard working drawings or using earlier designs at other locations, the design changes will generally be limited to exterior revisions to comply with the Installation Design Guide or other applicable local criteria, the selection of alternate interior materials when such changes are economically justified and to changes necessary for updating for conformance to current criteria.

3.1.7 Renovations. On renovation and modification projects provide separate plans showing demolition work required. Indicate items to be removed with dashed lines and hatched/poche'd areas to clearly show quantities and extent. Provide demolition notes to clarify scope of demolition work.

## 3.2 APPLICABLE PUBLICATIONS

The following publications form a part of this Manual to the extent indicated by the references thereto. Where a publication date is not indicated the current version at the time of contract award is applicable. This list is not intended to include all criteria that may apply.

Air Force Corporate Facilities Standards (AFCFS)

ABA Accessibility Standard for Department of Defense Facilities

AR 190-11 Physical Security of Arms, Ammunition, and Explosives

DoDEA 21<sup>st</sup> Century Education Facilities Specifications (<http://www.dodea.edu/>)

DoDEA Facilities Management Guides (<http://www.dodea.edu/>)

IBC International Building Code

IPC International Plumbing Code

NFPA 80 National Fire Protection Association, "Fire Doors and Windows"

NFPA 101 National Fire Protection Association, "Life Safety Code"

UFC 1-200-01 Design: General Building Requirements

UFC 1-200-02 High Performance and Sustainable Building Requirements

UFC 1-300-07A Design Build Technical Requirements

UFC 3-101-01 Architecture

UFC 3-110-03 Roofing

UFC 3-600-01 Design: Fire Protection Engineering for Facilities

UFC 4-010-01 DoD Minimum Antiterrorism Standard for Buildings

UFC 4-010-05 Sensitive Compartmented Information Facilities Planning Design and Construction

### **3.3 PRECONCEPT SUBMITTAL REQUIREMENTS**

3.3.1 Submittal. Certain projects may be of such magnitude or significance that in order to select the best possible design the COE may require a study to be made prior to concept submittal. Where a pre-concept submittal is specifically called for, the architect shall submit three separate schemes of the project (Scheme A, Scheme B, Scheme C) consisting of a site plan, floor plan and major elevations for each scheme.

3.3.2 Design Approach. Each scheme shall show the design approach in sufficient detail so that an evaluation by SAS and using agency together with the A-E may arrive at the most feasible scheme to prepare a concept package. This submittal shall be on full size drawing sheets printed at 1/2 size.

3.3.2.1 After selection of the most feasible scheme (A, B, or C), or a combination of the three, the pre-concept submittal requirements of other disciplines will be accomplished.

### **3.4 CODE 3 DESIGN SUBMITTAL REQUIREMENTS**

3.4.1 Submittal. Submittal content and format shall be as described in applicable year Project Definition Report (PDR) instructions (obtained from SAS PM).

### **3.5 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS**

3.5.1 Architectural design analysis. Provide a general description of the project. State the purpose, function, and capacities in sufficient detail to delineate and characterize functional features. Indicate expected occupancy (number of FTEs, visitors, students and residents as applicable and male/female ratio of each). Indicate expected hours of use. State HC-accessibility requirement for the project. Discuss how the project relates to the Installation Design Guide and the visual characteristics of the existing facilities around the site. Describe the following building systems: Exterior walls, floor finishes, interior partition types and finishes, ceilings, doors, windows, roofs and specialties. Describe the complete air barrier system in detail (all six sides). Include a statement of any proposed building-mounted signage or graphics. List all items that will be needed to complete the project but will not be included in the construction contract (Government-Furnished-Government-Installed).

3.5.2 Design Calculations.

3.5.2.1 Plumbing Fixture Calculations. Provide calculations indicating the required number of plumbing fixtures for the facility for men and women, including electric water coolers in accordance with UFC 3-420-01 Plumbing Systems. Unless otherwise indicated, number of fixtures shall be based on occupancy type and number of building occupants as calculated for NFPA 101.

When a standard design dictates a layout with plumbing fixture locations and counts toilet fixture/urinal/lavatory count calculations will not be required.

3.5.3 Specification List. Provide a list of guide specifications to be used for this project. Use SAS UFGS if applicable. UFGS specifications are available on the Internet at [http://www.wbdg.org/ccb/browse\\_cat.php?c=3](http://www.wbdg.org/ccb/browse_cat.php?c=3) . SAS UFGS are available at <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx> .



3.5.4 Fire Protection /Life Safety Design Analysis. Provide fire protection/ Life Safety design analysis as required by Chapter A-6, Fire Protection.

3.5.5 Architectural Drawings. Drawings shall be provided in sufficient detail and so annotated for the using service to visualize how the designer has interpreted the user's functional and operational requirements in his proposal for final design. Drawings shall include, but not be limited to, the following:

3.5.5.1 Floor Plan(s). Floor plans for each floor shall be shown at 1/4"=1'-0" or 1/8"=1'-0" scale (1:50 or 1:100 metric). If the main floor plans must be drawn in segments in order to comply with the requirements on the proper scale, provide a smaller scale composite floor plan that fits on one sheet for each floor. Show the following:

Exterior walls

Interior partitions

Doors and door swings

Windows

Room names

Cross referencing for sections

Overall dimensions to allow independent verification of gross area tabulation

Gross area tabulation on lower portion of first floor plate, calculated in accordance with UFC 3-101-01 except where facility criteria include an alternate method of calculating gross area.

3.5.5.2 Furniture Example Plan. Provide an example furniture plan to demonstrate functional aspects of floor plan and ability to meet program requirements. The furniture example plan is not a detailed plan. Show individual open office workstations as dashed line boxes.

3.5.5.3 Building Elevations. Provide building elevations at 1/8"=1'-0" (1:100 metric) for all major building elevations (at least four). Note all exterior materials, roof pitch, floor-to-floor and floor-to-eave dimensions. Indicate exterior colors.

3.5.5.4 Building and Wall Sections. Provide building cross section(s) at 1/8"=1'-0" (1:100 metric) that show major structural elements and building volume. Provide a typical exterior wall section at 3/4"=1'-0" (1:20 metric). Wall section shall be unbroken where practical and show materials, individual material and overall wall thicknesses, floor-to-floor height, grade and steps.

3.5.5.5 Fire Protection/Life Safety Plans. Provide fire protection/life safety plans as required by Chapter A-6, Fire Protection. Provide multi-disciplinary (Architectural, Mechanical and Electrical) Fire Protection/Life Safety Floor Plan that indicates fire suppression information including identification of fire/smoke partitions, locations of fire extinguishers, exit signs, pull stations, exit devices, emergency lights, smoke detectors, strobe and speaker locations and fire panel. Drawings shall indicate life safety code egress distances, including dead end corridor, common path of travel and distance to exit lengths. Scale shall match the scale of the composite floor plan and enlarged floor plans. Include a legend of symbols, a graphic scale, north arrow, and key plan indicating the area of the building represented on enlarged plan sheets. Also include the Fire Protection/Life Safety Code Review pasted on a sheet in the design drawing package. All Fire Protection/Life Safety Code drawings are for project record only and shall include a disclaimer:

"This drawing is for reference only. It is not part of the construction contract and all information contained here is located on the construction documents." The intent for including these

drawings with the contract drawings is to assure that upon archiving, the fire protection/life safety code intentions are not lost. Typically, Installations keep as-built drawings, but not the design analysis.

3.5.6 Single Line Perspectives. When required by contract, provide single line perspective drawings in accordance with paragraph 3.13.

### **3.6 PRELIMINARY (60%)DESIGN SUBMITTAL REQUIREMENTS**

This submittal consists of a limited number of drawings. Its purpose is to check progress, functional layout and incorporation of concept review comments. Design does not stop at this submittal.

3.6.1 Implement concept submittal review comments.

3.6.2 Architectural design analysis. The design analysis submitted at the 35 percent submittal stage shall be updated for design development.

3.6.3 Fire Protection /Life Safety Design Analysis. The fire protection/ Life Safety design analysis submitted at the 35 percent submittal stage shall be updated for design development.

3.6.4 Design Calculations:

3.6.4.1 Plumbing fixture calculations. Update plumbing fixture calculations submitted for the 35 percent design for design development. Provide calculations indicating the required number of plumbing fixtures for the facility for men and women, including electric water coolers in accordance with UFC 3-420-01 Plumbing Systems. Unless otherwise indicated, number of fixtures shall be based on occupancy type and number of building occupants as calculated for NFPA 101. When a standard design dictates a layout with plumbing fixture locations and counts toilet fixture/urinal/lavatory count calculations will not be required.

3.6.4.2 Gutter and Downspout Sizing Calculations.

Provide calculations indicating the size, type, and number of gutters and downspouts for roof drainage in accordance with UFC 3-110-03 Roofing.

3.6.5 Architectural Drawings. Drawings shall be provided in sufficient detail and so annotated for the using service to visualize how the designer has interpreted the user's functional and operational requirements in his proposal for final design. Drawings shall include, but not be limited to, the following:

3.6.5.1 Floor Plans. Provide floor plans as required for concept submittal, with the following additional information:

Stairs and utility spaces properly related to exterior access roads, parking, service areas, etc.

Structural grid system and columns

Fire rating and smoke resistance of walls and partitions

Door and Room numbers

Window type symbols

Cross referencing for enlarged floor plans

Floor slopes and floor drains

Downspouts

Dimensions

### 3.6.5.2 Schedules

3.6.5.2.1 Room Finish Schedule. Provide room finish schedule indicating floor, wall base, wainscot, wall and ceiling finishes and ceiling and wainscot heights. Provide a legend for finish abbreviations.

3.6.5.2.2 Door Schedule. Show door numbers, door and frame types, door size, door and frame materials and fire ratings.

3.6.5.3 Door and Frame Types. Door and frame types shall be placed on the same sheet, where possible, with the door schedules.

3.6.5.4 Window Types. Indicate for each window type dimensions, type of operation, frame material, glazing type and thickness.

3.6.5.5 Enlarged Floor Plans. Provide enlarged floor plans for toilet rooms, locker rooms, break rooms, stairs and other major elements at 1/4"=1'-0" or 1/2"=1'-0"(1:50 metric). Show toilet partitions, toilet accessory schedule and HC clearances as required.

3.6.5.6 Exterior Elevations. Provide elevations as required for concept submittal, with the following additional information:

Louvers

Gutters and downspouts

Visible structural frame

3.6.5.7 Sections. Provide typical building sections through the entire building showing coordination with structural system and room volumes. Provide wall sections showing typical exterior wall conditions including porches, loading docks and other special conditions.

3.6.5.8 Interior Elevations. Provide interior elevations for all unique architectural features of the building including, built in casework, lockers, restroom elevations, etc. Provide sectional details for various casework types. Interior Elevations shall back reference to architectural floor plans. Include drawing notations, dimensions as required, a graphic scale, and detail callouts.

3.6.5.9 Partition Types. Provide sections of interior partition types indicating wall materials, finishes, base anchorage, termination at of top of wall, firestopping, fire rating including UL listing and STC rating. Partition types shall correspond to partition tags found on the architectural floor plans.

3.6.5.10 Roof Plan. Provide a roof plan showing roof slopes, gutters and downspouts, roof drains and scuppers.

3.6.5.11 Equipment Plans and Schedules. Where food preparation and serving equipment is required, provide equipment plans and schedule fully defining the equipment. Schedule may be provided on the equipment plan sheet or on a separate sheet immediately following. Medical facility casework and equipment schedules shall be provided in a similar manner. Indicate by schedule which items the Contractor shall furnish and which shall be furnished by the Government.

3.6.5.12 Fire Protection/Life Safety Plans. Provide fire protection/life safety plans as required by Chapter A-6, Fire Protection. The Fire Protection/Life Safety Plans submitted at the 35 percent submittal stage shall be updated for design development. Provide multi-disciplinary (Architectural, Mechanical and Electrical) Fire Protection/Life Safety Floor Plan that indicates fire suppression information including identification of fire/smoke partitions, locations of fire extinguishers, exit signs, pull stations, exit devices, emergency lights, smoke detectors, strobe and speaker locations and fire panel. Drawings shall indicate life safety code egress distances, including dead end corridor, common path of travel and distance to exit lengths. Scale shall match the scale of the composite floor plan and enlarged floor plans. Include a legend of symbols, a graphic scale, north arrow, and key plan indicating the area of the building represented on enlarged plan sheets. Also include the Fire Protection/Life Safety Code Review pasted on a sheet in the design drawing package. All Fire Protection/Life Safety Code drawings are for project record only and shall include a disclaimer: "This drawing is for reference only. It is not part of the construction contract and all information contained here is located on the construction documents." The intent for including these drawings with the contract drawings is to assure that upon archiving, the fire protection/life safety code intentions are not lost. Typically, Installations keep as-built drawings, but not the design analysis.

3.6.6 Specifications. The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

## **3.7 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS**

3.7.1 Implement Concept and Preliminary review comments.

3.7.2 Architectural Design Analysis. The design analysis submitted at the 60 percent submittal stage shall be updated for design development.

3.7.3 Design Calculations.

3.7.3.1 Plumbing fixture calculations. Update plumbing fixture calculations submitted for the 35 percent design for design development. Provide calculations indicating the required number of plumbing fixtures for the facility for men and women, including electric water coolers in accordance with UFC 3-420-01 Plumbing Systems. Unless otherwise indicated, number of fixtures shall be based on occupancy type and number of building occupants as calculated for NFPA 101. When a standard design dictates a layout with plumbing fixture locations and counts toilet fixture/urinal/lavatory count calculations will not be required.

3.7.3.2 Gutter and Downspout Sizing Calculations.

Provide calculations updated for design development indicating the size, type, and number of gutters and downspouts for roof drainage in accordance with UFC 3-110-03 Roofing.

3.7.4 Fire Prevention/Life Safety Design Analysis. The fire protection/ Life Safety design analysis submitted at the 60 percent submittal stage shall be updated for design development.

3.7.5 Hardware Consultant Qualifications. Consultant shall have DHI legacy certification; AHC (Architectural Hardware Consultant) and EHC (Electrified Hardware Consultant) or New DHI Certifications; DHC (Door and Hardware Consultant), DHSC (Door and Hardware Specification Consultant) and ACSC (Access Control System Consultant). Provide name and statement of qualification of certified hardware consultant used to select and specify the hardware sets.

3.7.6 Arms Room Certification. Submit signed and dated Arms Room Checklist for each Arms Room in project. Obtain checklist from SAS Project Manager. Include as an appendix to Design Analysis.

3.7.7 Final Drawings. Final drawings shall show all pertinent plans, elevations, sections, details, schedules and notes to present a complete description of the construction required. Architectural drawings shall be coordinated with the structural, mechanical, electrical and site drawings and with the specifications. Dimensions, schedules, sections and details shall be completely checked. Door, window, and space numbers or symbols shall be properly shown. Locations of wall sections and cross sections shall be shown on plans and elevations. All errors and discrepancies noted shall be corrected. Assure drawing index is complete and coordinated with the drawings. Coordinate reflected ceiling plans with electrical and mechanical plans. Roof details shall be provided for all roof conditions and shall be no smaller than 1:5 metric (3"=1'-0" inch-pound). Lapping of flashings and membranes shall be clearly shown and dimensioned on roof details. Brick expansion joints shall be shown and labeled on floor plans and building elevations. CMU control joints shall be shown and labeled on floor plans. Floor slopes shall be diagrammed and floor drains shall be shown on floor plans. Tile expansion joints (including those required over slab joints) shall be shown and labeled on floor plans or tile pattern plans. Ceiling access panels shall be shown on reflected ceiling plans. Gutter expansion joints and downspouts shall be shown and labeled on roof plans.

3.7.8 Fire Protection/Life Safety Plans. Provide fire protection/life safety plans as required by Chapter A-6, Fire Protection. The Fire Prevention/Life Safety Plans submitted at the 60 percent submittal stage shall be updated for design development.

Provide multi-disciplinary (Architectural, Mechanical and Electrical) Fire Protection/Life Safety Floor Plan that indicates fire suppression information including identification of fire/smoke partitions, locations of fire extinguishers, exit signs, pull stations, exit devices, emergency lights, smoke detectors, strobe and speaker locations and fire panel. Drawings shall indicate life safety code egress distances, including dead end corridor, common path of travel and distance to exit lengths. Scale shall match the scale of the composite floor plan and enlarged floor plans. Include a legend of symbols, a graphic scale, north arrow, and key plan indicating the area of the building represented on enlarged plan sheets. Also include the Fire Protection/Life Safety Code Review pasted on a sheet in the design drawing package. All Fire Protection/Life Safety Code drawings are for project record only and shall include a disclaimer:

"This drawing is for reference only. It is not part of the construction contract and all information contained here is located on the construction documents." The intent for including these drawings with the contract drawings is to assure that upon archiving, the fire protection/life safety code intentions are not lost. Typically, Installations keep as-built drawings, but not the design analysis.

3.7.9 Air Barrier Plans, Sections and Details. Provide composite floor plans and multiple building sections highlighting the location of the building air barrier system. Provide air barrier details for each juncture of walls/floor slabs, walls/roof, doors and window openings, noting each air barrier component and how each air barrier components transitions to the next air barrier component to create a system. Air Barrier sections shall be cross referenced to air barrier details; air barrier

details shall be back referenced to air barrier sections. Include a graphic scale, north arrow, and section and detail callouts.

3.7.10 Specifications. Specifications submitted for the 60 percent submittal shall be updated for design development. Specifications shall be finalized with all edits accepted.

3.7.11 Rendering. When required by contract, provide rendering per paragraph 3.12.

### **3.8 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**

In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

3.8.1 Implement final review submittal comments and submit all revised documents that show implementation of the comments.

3.8.2 Verify consistency between plans, specifications and final corrections.

### **3.9 REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP PACKAGES**

3.9.1 General. Unless indicated otherwise, Army RFPs shall be prepared using the MILCON Transformation RFP template and the online RFP “wizard”. Contact the SAS Project Manager for access to the RFP “wizard”. Unless indicated otherwise, Air Force and all other RFPs shall be based upon “partial” design development as defined by UFC 1-300-07A.

#### **3.9.2 MILCON Transformation RFP Template**

3.9.2.1. Develop complete RFP using current MILCON Transformation RFP Template documents and the online “wizard”. Follow MILCON Transformation RFP Implementation Guidelines (located at the “wizard”) in developing the RFP. Incorporate the basic premises of MILCON Transformation in the RFP.

#### **3.9.2.2. Facility-Specific Functional Requirements, Applicable Criteria and Technical Requirements.**

For Army standard designs with completed facility-specific functional requirements, applicable criteria and technical requirements paragraph (Statement of Work (SOW) paragraph 3) developed by the Center of Standardization (COS) and uploaded in the wizard, use the standard SOW paragraph 3 provided. For Army standard designs without completed SOW paragraph 3 developed by the COS and uploaded in the wizard, develop SOW paragraph 3 based on input from and coordination with the COS. For modified Army standard designs and unique non-standard facilities, develop SOW paragraph 3 based on input from and coordination with the User and COS if applicable.

3.9.2.3. Project-Specific Architectural Requirements. Coordinate with the Installation and develop SOW paragraph 6 (Project-Specific Requirements) and RFP appendices. Incorporate Installation Design Guide (IDG) to the extent that IDG compliance does not jeopardize project award within budget.

3.9.2.4. Coordinate with the Installation and provide technical support for Installation requests for deviations from MILCON Transformation RFP requirements as needed.

3.9.2.5 Draft RFP Submittal Requirements. Provide Statement of Work document to include, as a minimum: description of required spaces, minimum net areas, number of occupants, hours of occupation, features, furniture and equipment, adjacencies, special requirements, project-specific requirements, appendices.

3.9.2.6 Final RFP Submittal Requirements.

3.9.2.6.1 Implement draft RFP submittal review comments.

3.9.2.6.2 Verify consistency between drawings, appendices and RFP text.

3.9.2.6.3 Update RFP to reflect changes to MILCON Transformation RFP Template documents as needed during RFP preparation.

3.9.3 "Partial" Design Development RFP.

Prepare in accordance with UFC 1-300-07A. Unless indicated otherwise, A-E shall be furnished an electronic format sample or template for the written technical requirements portion of the RFP to be edited for the specific project.

3.9.3.1 Draft RFP Submittal Requirements. Provide the following:

Concept floor plan(s) as described in UFC 1-300-07A.

Concept building elevations as described in 3.5 above.

Concept building and/or wall sections for special design conditions.

Concept Life Safety Plans as described in Chapter A-6 Fire Protection to include, as a minimum, all occupancy classifications, egress requirements and egress provisions.

Functional requirements document to include, as a minimum, for each space: description of use of space, minimum net area, number of occupants, hours of occupation, features, furniture and equipment, adjacencies, finishes, ceiling height.

Specification indicating architectural design requirements.

3.9.3.2 Final RFP Submittal Requirements.

3.9.3.2.1 Implement draft RFP submittal review comments.

3.9.3.2.2 Verify consistency between drawings , specifications, appendices and RFP text.

## 3.10 TECHNICAL REQUIREMENTS

The following technical requirements apply to all projects except MILCON Transformation RFPs.

3.10.1 Site Work.

3.10.1.1 Access to Entrances. All stoops, steps, or similar required access to entrances that will normally be built by a building Contractor as differentiated from sidewalks, driveways, etc., which are normally constructed by a paving subcontractor, shall be shown on the architectural drawings.

### 3.10.2 Masonry.

3.10.2.1 Interior Walls and Partitions. Concrete masonry units in interior masonry walls and partitions shall be not less than 200 mm (8 inches) in nominal thickness.

3.10.2.2 Grout-filled cavities between wythes of exterior masonry walls is not allowed. Grouting of reinforced concrete masonry unit cores is allowed.

3.10.2.3 Single wythe masonry exterior building walls are not allowed.

3.10.2.4 Brick Expansion Joints (BEJ) and CMU Control Joints (CJ). Provide brick expansion joints and CMU control joints in accordance with the spacing guidelines in UFC 1-200-01, Tables 1-2 and 1-3.

3.10.2.5 Brick Detailing. All brick detailing, including flashing and sills, shall be in accordance with the latest edition of the Technical Notes on Brick Construction published by the Brick Industry Association (BIA).

3.10.3 Miscellaneous Metals. All access panels required to service mechanical items normally furnished and installed by the non-mechanical trades shall be shown on the architectural drawings. Make sure that access panels, when required, are specified.

### 3.10.4 Thermal and Moisture Protection.

3.10.4.1 Air Barrier. Provide air barrier and testing per UFC 3-101-01.

3.10.4.2 Exterior Insulation Finish System (EIFS). Comply with UFC 3-101-01. EIFS system shall be water-managed type with drainage for intruded moisture. Edit guide specification for this feature and provide typical details showing it.

3.10.4.3 Thermal Envelope. Ensure conditioned facilities have a complete uninterrupted thermal envelope. Water and fire sprinkler pipes must be located inside the building thermal envelope.

3.10.4.4 Roof Slope. Comply with UFC 3-110-03. The roof slope for low-slope (built-up or membrane) roof shall be minimum 1/2 inch per foot and maximum 2 inches per foot. Structural standing seam metal roofs shall be a minimum of 1/2 inch per foot roof slope.

3.10.4.5 Sheet Metal. In all cases, sheet metal for various elements used throughout a building shall be of the same basic metal. Atmospheric conditions shall be considered in the selection of exposed sheet metal.

3.10.4.6 Louvers. All louvers shall be storm louvers and shall have enclosed drainable sill pans with end dams.

3.10.4.7 Downspouts. When downspouts are required, they shall not drain directly onto a walk, platform, or open ground. When downspouts must occur at walks or platforms, they shall pass through or under into underground drains or toward open ground beyond. Downspouts draining onto open ground shall be diverted to prevent erosion by utilizing splash blocks. Use of interior roof drains shall be avoided where possible. When interior roof drains are used provide



overflow drains or scuppers. Where downspouts discharge onto a roof below, provide splash pans.

3.10.4.8 Gutters. Gutters shall be exposed. Concealed gutters shall not be used. The A-E shall provide specific details on the plans of how expansion joints are to be constructed as well as appropriate fabrication and installation details.

3.10.4.9 Roof Details. Roof details shall be in accordance with NRCA Roofing and Waterproofing Manual, latest edition.

3.10.4.10 Spray Foam and Rigid Insulation. Comply with UFC 3-600-01 and IBC Section 2603 except IBC Section 2603.10 is not applicable. All spray foam and rigid insulation must be separated from the building interior (including attic and concealed spaces above ceiling) by being directly covered with ½ inch thick gypsum board thermal barrier.

3.10.5 Doors and Windows.

3.10.5.1 All pedestrian doors shall be 2100 mm (7 feet 0 inch or 7 feet 2 inches), or 2400 mm (8 feet 0 inch) high except in family housing where they may be 2000 mm (6 feet 8 inches). Door openings shall, in general, be 900 mm (3 feet 0 inch) in width, except for special purpose doors, toilet rooms, closets, family housing, etc.

3.10.5.2 Doors to rooms shall be adequate size to accommodate the installation and removal of furniture and equipment installed herein without requiring demolition.

3.10.5.3 Exterior Doors. Except in underground structures, doors to boiler or mechanical rooms shall normally be provided to the exterior for all buildings. Doors from the power rooms, generator rooms, etc., should be to the outside of the building only.

3.10.5.4 Special type doors such as rolling doors shall be adequately designed to safely resist the required wind pressures. Rolling steel or aluminum doors shall be designed so as to permit operation of the door at maximum wind velocities defined in the area where used.

3.10.5.5 Louvers. Overall size of return air or air intake louvers located in doors shall be indicated in the Door Schedule. Minimum bottom rail dimension shall be 3 inches and the minimum stile dimension shall be 5 inches.

3.10.5.6 Door and Window Connections. Door and window connections/anchorage to exterior wall shall be designed to comply with antiterrorism/force protection criteria. Anchorage/connection design shall be accomplished by designer and indicated on the project drawings.

3.10.6 Door Hardware

3.10.6.1 Hardware Consultant. A certified hardware consultant shall be used to select and specify the hardware sets. Consultant shall have DHI legacy certification; AHC (Architectural Hardware Consultant) and EHC (Electrified Hardware Consultant) or New DHI Certifications; DHC (Door and Hardware Consultant), DHSC (Door and Hardware Specification Consultant) and ACSC (Access Control System Consultant).

3.10.6.2 Coordination of door numbers and hardware set numbers shall be accomplished by indicating hardware set numbers for each door on the Door Schedule or by listing applicable door numbers at each hardware set heading in the hardware schedule. Do not indicate hardware set numbers on the floor plans.

3.10.6.3 Hardware sets. Hardware set components shall be indicated using ANSI designations.

3.10.6.4 Proprietary Hardware. Under no circumstances shall proprietary hardware be specified unless a specific waiver has been obtained authorizing its use.

3.10.6.5 Hardware Sets. When selecting hardware sets, limit the use of closers to reasonable locations. Parallel arm closers are required when the hinged jamb is less than 178 mm (7 inches) from the adjacent wall. Door locations should be studied in the design stage to eliminate the need for parallel arm closers. Limit the use of door coordinators at pairs of doors only in those locations where removable mullions cannot be used. Except in cases where aesthetics are extremely important AND the door will not receive heavy use, do not use concealed vertical rod exit devices.

3.10.7 Finishes.

3.10.7.1 Finishes Disclaimer. Interior and exterior finishes may be specified by using manufacturer and product names. When this is done, a disclaimer must be placed on the drawings or in the specification where this is done that states the following:

“The manufacturer's names and their products referenced indicate the color, texture, and pattern required for the materials listed. The products furnished shall meet the color, texture, and pattern indicated as well as the material quality and performance specified in the applicable technical section. The use of manufacturer's names and products do not preclude the use of other manufacturer's products of approved equal color, texture, and pattern as long as all requirements in the technical sections are met”.

3.10.7.2 Acoustical Tile. In electronic and communications facilities in which avoidance of dust is a major consideration, acoustical treatment shall be limited to acoustical tile with non-dusting characteristics. Square tile 600mm x 600mm (24" x 24") shall be used at all areas. Insulation shall not be placed directly above acoustic tile ceilings.

3.10.7.3 Ceramic Tile on Concrete Masonry Units (CMU). Utilize thickset (setting bed) method for installation of ceramic tile when applied directly to CMU.

3.10.8 Floor Drains and Slopes. Floor drains and showerheads shall be shown on architectural drawings as well as on mechanical drawings, and shall be closely coordinated. All floors in areas requiring drains shall be sloped toward the drains, and coordinated with structural drawings for depressed slab requirements.

3.10.9. Handicapped Accessibility. Where facilities for the handicapped are to be included in whole or in part, the design shall be in accordance with the ABA Accessibility Standard for Department of Defense Facilities.

3.10.10. Arms Rooms and SCIFs. Arms Rooms shall be designed in conformance with AR 190-11. Arms Room Checklist (obtain from SAS Project Manager) will be completed by the prime A-

E Design Contractor representative and submitted at the final design submittal. SCIFs shall be designed in conformance with UFC 4-010-05.

3.10.11. Egress During Construction. For renovation of an occupied building, drawings and specs shall include provisions to ensure egress requirements for occupied areas are met during construction.

3.10.12 Renovations and Additions. For all renovation and addition projects the Fire Protection Design Analysis shall address the entire existing building including the renovations and/or additions (not just the addition or portions receiving renovations).

### 3.11 AESTHETIC GUIDANCE

3.11.1 Discussion. The aesthetic quality of an area is not determined solely by the architecture of its buildings, the complexity of its site development and landscape features, or the size, shapes, colors, and textures which are predominant; it is determined by how well all these elements function together and complement existing natural and man-made features.

3.11.2 Policy. The A-E shall be responsible for insuring that proper attention is paid to achieving an aesthetic design solution, which includes harmony of design and the visual linkage of architecture to the surrounding community. New design projects shall respect the architectural character of existing facilities that are to remain and that are considered to be architecturally appropriate for the environment. Where the architecture of existing permanent facilities reflect a predominant character or style, the new facilities should be designed to be in harmony with that character or style. This emphasis will also be placed on landscaping and structures other than buildings. Follow the Installation Design Guides or other applicable local criteria.

The architect shall take the lead on ensuring aesthetic coordination is accomplished for all design disciplines. The following items will be addressed in each design:

- a. All designers shall consider the effects of their decisions upon the project aesthetics.
- c. During concept design, a site visit will be made for familiarization and color photographs taken of the surrounding area.
- e. Special attention shall be given to color and materials selection in relationship with existing surroundings.
- f. Landscaping, exterior lighting, and signage shall be given the same aesthetic consideration as the structures.
- g. The exterior treatment of renovated buildings shall be in harmony with the effort to improve the aesthetic quality of an area.
- h. Potential site adapted building(s) shall be reviewed with the same aesthetic criteria required for new design.
- i. The screening of exterior equipment, i.e., chillers, cooling tower, transformers, etc., will be accomplished whenever possible.

- j. Provide underground electrical service lines whenever possible.
- k. Primary entrances to buildings shall be architecturally delineated so entrance location is obvious to a visitor approaching the building.
- l. Restrooms shall be arranged to ensure visual privacy from adjacent areas. This will include consideration of the views into rooms due to mirror placement.

### **3.12 EXTERIOR PERSPECTIVES AND RENDERING**

3.12.1 Exterior Perspectives and Rendering. The exterior perspective and rendering requirement applies to facilities having a significant visual impact within an installation and/or occupancy which requires special design attention. When required by contract, provide the following:

3.12.1.1 Concept: Single line perspectives indicating the three dimensional aspects of the facility with emphasis on the main building features, shall be provided at concept design.

The perspectives will illustrate the view planned for the final color rendering. In addition, 8-inch by 10-inch samples shall be provided showing the rendering techniques to be used. When required by contract, provide three soft line sketches of alternate exterior treatments (three different exterior treatments of same floor plan) depicting the exterior design motif, massing, building materials, color, texture, and site features. All alternatives shall be within construction cost limit.

3.12.1.2 Final: A 20-inch by 30-inch full color rendering by a professional architectural renderer and two full size true color copies shall be provided at the final design submittal, showing the view approved in the single line perspective and illustrating the colors and patterns of exterior building materials. (An example of the color medium to be used shall be submitted for approval prior to submittal of full color rendering.) In addition, an electronic version of the image on DVD or CD shall be provided. The project title and location shall appear on the rendering front side. The project title, line item number, fiscal year and location shall appear on the backside.

3.12.2 Submittals. Provide the required information as indicated below:

3.12.2.1 Concept Design: Include one copy of concept requirements in the following submittal packages: Project Manager, Architectural (EN-DAS).

3.12.2.2 Final Design: Include final requirements in the final submission to the Project Manager. The rendering and full size copies shall be matted and framed.

\*\*\* End of Section \*\*\*

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- 4.2.5 Air Conditioning, Heating and Refrigeration Institute (AHRI)
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## CHAPTER A-4

### MECHANICAL

#### 4.1 GENERAL

This chapter provides the minimum requirements and guidance for preparation and development of the following design aspects: Heating, ventilating, air conditioning (including hydronic distribution systems), plumbing (including compressed air, fuel gas, and medical gas systems), central energy plants, and P.O.L. systems. Further guidance for these mechanical systems will be provided in the Specific Instructions, if required. Guidance for other mechanical systems will also be provided in the Specific Instructions.

#### 4.2 APPLICABLE PUBLICATIONS

This list is a minimum requirement, and is not intended to be an all inclusive requirement. The most current editions of the publications listed below, as of the date of contract award, shall be used, unless directed otherwise.

##### 4.2.1 International Code Council, Inc.

ICC IBC	International Building Code
ICC IPC	International Plumbing Code
ICC IMC	International Mechanical Code
ICC IFGC	International Fuel Gas Code
ICC IRC	International Residential Code

##### 4.2.2 Unified Facilities Criteria (UFC)

1-200-02	High Performance and Sustainable Building Requirements
1-300-07A	Design-Build Technical Requirements
3-400-02	Design: Engineering Weather Data
3-401-01	Mechanical Engineering
3-410-01	Heating, Ventilating, and Air Conditioning Systems
3-410-02	Direct Digital Control for HVAC and Other Building Systems
3-410-04	Industrial Ventilation
3-420-01	Plumbing Systems
3-420-02FA	Compressed Air

3-430-01FA	Heating and Cooling Distribution Systems
3-430-02FA	Central Steam Boiler Plants
3-430-07	Operations and Maintenance: Inspection and Certification of Boilers and Unfired Pressure Vessels
3-430-08N	Central Heating Plants
3-430-09	Exterior Mechanical Utility Distribution
3-430-11	Boiler Control Systems
3-440-01	Facility-Scale Renewable Energy Systems
3-450-01	Noise and Vibration Control
3-460-01	Design: Petroleum Fuel Facilities
3-460-03	O&M: Maintenance of Petroleum Systems
3-470-01	Utility Monitoring and Control System (UMCS) Front End and Integration
3-600-01	Fire Protection Engineering for Facilities
4-010-01	DoD Minimum Antiterrorism Standards for Buildings
4-010-06	Cybersecurity of Facility-Related Control Systems
4-826-10	Design: Refrigeration Systems for Cold Storage
4-832-01N	Design: Industrial and Oily Wastewater Control

#### 4.2.3 Department of the Army Technical Instructions (TI)

TI 800-01 Design Criteria

#### 4.2.4 American Society of Mechanical Engineers (ASME)

ASME B31.1 Power Piping

ASME B31.3 Process Piping

ASME B31.5 Refrigeration Piping and Heat Transfer Components

ASME B31.8 Gas Transmission and Distribution Piping Systems

ASME B31.9 Building Services Piping

ASME BPVC Boiler and Pressure Vessels Code



#### 4.2.5 Air Conditioning, Heating and Refrigeration Institute (AHRI).

ANSI/AHRI Std 210/240	Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment
ANSI/AHRI/CSA Std 310/380	Standard for Packaged Terminal Air-Conditioners and Heat Pumps
AHRI Std 410	Forced-Circulation Air-Cooling and Air-Heating Coils
AHRI Std 430	Performance Rating of Central Station Air-handling Unit Supply Fans
AHRI Std 440	Performance Rating of Room Fan-Coils
AHRI Std 550/590	Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle
ANSI/AHRI Std 560	Absorption Water Chilling and Water Heating Packages
AHRI Std 840	Performance Rating of Unit Ventilators
AHRI Std 880	Performance Rating of Air Terminals
AHRI Std 1060	Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Heat Equipment

#### 4.2.6 American Conference of Governmental Industrial Hygienists (ACGIH)

ACGIH 2098	Industrial Ventilation: A Manual of Recommended Practice for Design
ACGIH 2092S	Industrial Ventilation: A Manual of Recommended Practice

#### 4.2.7 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), Inc. Standards

ASHRAE HVAC Applications Handbook

ASHRAE HVAC Systems and Equipment Handbook

ASHRAE Fundamentals Handbook

ASHRAE Refrigeration Handbook

ANSI/ASHRAE Standard 15 Safety Standard for Refrigeration Systems

ASHRAE Standard 55 Thermal Environmental Conditions for Human Occupancy

ASHRAE Standard 62.1 Ventilation for Acceptable Indoor Air Quality

ASHRAE Standard 90.1	Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE Standard 90.2	Energy-Efficient Design of Low-Rise Residential Buildings
ASHRAE Standard 189.1	Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
ASHRAE Standard 202	Commissioning Process for Buildings and Systems
ASHRAE Guideline 0	The Commissioning Process

#### 4.2.8 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), Inc.

ANSI/SMACNA 008	IAQ Guidelines for Occupied Buildings Under Construction
SMACNA 1378	Thermoplastic Duct (PVC) Construction Manual
SMACNA 1403	Accepted Industry Practice for Industrial Duct Construction
SMACNA 1429	HVAC Systems Commissioning Manual
SMACNA 1520	Round Industrial Duct Construction Standards
SMACNA 1767	Kitchen Ventilation Systems & Food Service Equipment Fabrication & Installation Guidelines
SMACNA 1780	HVAC Systems – Testing, Adjusting and Balancing
SMACNA 1793	Architectural Sheet Metal Manual
SMACNA 1819	Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
SMACNA 1858	HVAC Sound And Vibration Manual
SMACNA 1884	Fibrous Glass Duct Construction Standards
SMACNA 1922	Rectangular Industrial Duct Construction Standards
SMACNA 1966	HVAC Duct Construction Standards Metal and Flexible
SMACNA 1972 CD	HVAC Air Duct Leakage Test Manual
SMACNA 1981	Seismic Restraint Manual Guidelines for Mechanical Systems
SMACNA 1987	HVAC Duct Systems Inspection Guide

#### 4.2.9 National Fire Protection Association (NFPA)

NFPA 30	Flammable and Combustible Liquids Code
NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages
NFPA 31	Standard for the Installation of Oil-Burning Equipment
NFPA 37	Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 54	National Fuel Gas Code
NFPA 55	Compressed Gases and Cryogenic Fluids Codes
NFPA 58	Liquefied Petroleum Gas Code
NFPA 80	Standard for Fire Doors and Other Opening Protectives
NFPA 82	Standard on Incinerators and Waste and Linen Handling Systems and Equipment
NFPA 85	Boiler and Combustion Systems Hazards Code
NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	Standard for the Installation of Warm Air Heating and Air Conditioning Systems
NFPA 91	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids
NFPA 96	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
NFPA 99	Health Care Facilities Code
NFPA 101	Life Safety Code
NFPA 105	Standard for Smoke Door Assemblies and Other Opening Protectives
NFPA 211	Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 214	Standard on Water-Cooling Towers
NFPA 407	Standard for Aircraft Fuel Servicing

NFPA 409	Standard on Aircraft Hangars
NFPA 418	Standard for Heliports
4.2.10 Guide Specifications	
See Chapter 11 of this manual.	
4.2.11 Engineering Regulations (ER)	
ER 1110-1-12	Engineering and Design – Quality Management
ER 1110-1-8173	Energy Modeling and Life Cycle Cost Analysis
ER 1110-345-723	Total Building Commissioning Procedures
4.2.12 American National Standards Institute (ANSI)	
ANSI Z21.10.1/CSA 4.1	Gas Water Heaters Vol. I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less
ANSI Z21.10.3/CSA 4.3	Gas-Fired Water Heaters Vol. III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous
ANSI Z21.13/CSA 4.9	Gas-Fired Low Pressure Steam and Hot Water Boilers
ANSI Z21.15/CSA 9.1	Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves
ANSI Z21.18/CSA 6.3	Gas Appliance Pressure Regulators
ANSI Z21.21/CSA 6.5	Automatic Valves for Gas Appliances
ANSI Z21.22/CSA 4.4	Relief Valves for Hot Water Supply Systems
ANSI Z21.24/CSA 6.10	Connectors for Gas Appliances
ANSI Z21.41/CSA 6.9	Quick-Disconnect Devices for Use with Gas Fuel Appliances
ANSI Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
ANSI Z21.47/CSA 2.3	Gas-Fired Central Furnaces
ANSI Z21.66/CGA 6.14	Automatic Vent Damper Devices for Use with Gas-Fired Appliances
ANSI Z21.69/CSA 6.16	Connectors for Movable Gas Appliances
ANSI Z21.78/CSA 6.20	Standard Specification for Combination Gas Controls for Gas

## Appliances

ANSI Z21.80/CSA 6.22	Line Pressure Regulators
ANSI Z21.86/CSA 2.32	Vented Gas-Fired Space Heating Appliances
ANSI Z358.1	Emergency Eyewash and Shower Equipment
ANSI Z83.4/CSA 3.7	Non-Recirculating Direct Gas-Fired Heating and Forced Ventilation Appliances for Commercial and Industrial Application
ANSI Z83.8/CSA 2.6	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, and Gas-Fired Duct Furnaces
ANSI Z83.19/CSA 2.35	Gas-Fired High-Intensity Infrared Heaters

### 4.2.13 Energy Criteria

See Chapter A-7 of this manual.

## 4.3 PRECONCEPT (PROGRAMMING) SUBMITTAL REQUIREMENTS

No requirements for this section.

## 4.4 CODE 3 DESIGN SUBMITTAL REQUIREMENTS

4.4.1 Any Base of project specific requirements will be provided with specific instructions to contract or delivery order.

## 4.5 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS

4.5.1 Concept Design Analysis. The analysis will form the basis of the future Preliminary and Final Design Analyses, as required for Preliminary (60 Percent) Design Submittal and Final (100 Percent) Design Submittal of this chapter, depending on submittal requirements, and will contain the following in narrative form:

a. Heating, Ventilating, and Air Conditioning.

(1) Criteria listings - manuals, pamphlets, technical books, etc.

(2) Design conditions used in calculations - inside and outside temperatures, personnel load, equipment heat release (if any), outside air or ventilation requirements, U-factors, and other special conditions.

(3) Block loads for heating and cooling shall be calculated using ASHRAE-based computer-generated load calculations. Block load program inputs and outputs shall be provided. Where passive solar applications prove feasible and cost effective (see CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS), the Designer shall employ a load calculation method that can incorporate all applicable passive solar factors. All load calculation software must be approved in advance by the Savannah District. For all

calculations (cooling load, heating load, pipe sizing, duct sizing, etc.), the design analysis shall contain layout sketches that show how the building or system was segmented for computer input.

(4) Type of systems considered and full description including justification for selection, description of air distribution, zoning and control description, and description and justification for any connections to existing systems. Provide justification for chosen systems based on life cycle cost analysis. See Chapter A-7 of this manual for additional life cycle cost analysis requirements.

(5) Brief description of various items of equipment. Indicate operating temperatures and capacities.

(6) Description of piping systems including type of pipe, insulation requirements, and whether concealed or exposed.

(7) Description of any demolition or asbestos removal required. See CHAPTER A-12, ASBESTOS AND OTHER HAZARDOUS MATERIALS (IDENTIFICATION, HANDLING AND REMOVAL) if asbestos is encountered.

(8) A list of items for which any additional criteria, clarification, or guidance is required.

(9) Documentation of compliance with ASHRAE 90.1 and ASHRAE 62.1.

b. Plumbing.

(1) Criteria listing - manuals, codes, etc.

(2) Plumbing calculations as necessary to determine number of fixture units, cold and hot water capacity requirements, and equipment or capacities of miscellaneous and special systems.

(3) Fixture determination listing quantity and type of fixtures for both men's and women's toilets, and other fixtures such as drinking water fountains, service sinks, etc. Indicate male and female building population, if available.

(4) Description of domestic water heating and storage equipment, including capacity, type (gas, electric, boiler, water), materials, and insulation. (Life cycle cost justification will be provided with concept design analysis for justification of selection, if appropriate, in accordance with Chapter A-7 of this manual.)

(5) Piping types and location (concealed or exposed), together with material proposed and insulation requirements.

(6) Brief description of miscellaneous systems such as compressed air (capacity, pressure, piping, location of air outlets, etc.), roof drainage, natural gas (pressure, quantity, and equipment to be served), and other special systems.

(7) Description of any demolition or asbestos removal required. See CHAPTER A-12, ASBESTOS AND OTHER HAZARDOUS MATERIALS (IDENTIFICATION, HANDLING AND REMOVAL) if asbestos is encountered.

(8) A list of items for which additional criteria, clarification, or guidance is required.

c. Outside Utilities.

(1) Criteria listings - manuals, pamphlets, codes, etc.

(2) Pipe size calculations in tabular form. Where project utilities are extensions of existing systems, it must be shown that these are adequate for the additional load requirements.

(3) Description of the utility systems chosen. Provide justification for chosen systems based on life cycle cost analysis.

(4) Topographic Survey requirements for utility distribution routing shall be in accordance with CHAPTER A-1, SITE DEVELOPMENT, INCLUDING WATER AND SEWER.

(5) A list of items for which additional criteria, clarification, or guidance is required.

d. Renovation Recommendations. The A-E shall make all recommendations for renovation requirements in existing buildings and/or recommendations for the use of existing mechanical systems. Recommendations shall include all supporting rationale, assumptions, calculations, condition of existing equipment, etc.

4.5.2 Concept Drawings. Provide plan view showing the following:

a. Heating, Ventilating, and Air Conditioning. Heating, ventilating, and air conditioning equipment layout - chillers or refrigeration compressors, boilers, pumps, condensers or cooling tower, air handling units, fans, air distribution duct layout (may be single line), hoods, and other items of major equipment required for the facility.

b. Plumbing. Plumbing fixture layout, floor and area drains, and plumbing equipment layout (hot water generator, storage tank, air compressors, etc.).

c. Outside Utilities. Indicate locations and sizes of outside utilities, heating hot water, steam, chilled water, and natural gas lines where required to support the project. Show same scale as other sitework drawings.

d. Mechanical Room(s). Provide a 1:50 scale plan(s) in metric design (or 1/4 inch = 1 foot) of the mechanical room(s) indicating all equipment to be located therein with at least 1 meter (3 feet) of clearance between each item and the nearest adjacent wall/ceiling or electrical/control panel. Space required for placement of all such items as coils, filters, motors, and belts shall be shown on the plan. If electrical panels are located within the mechanical room, indicate the space around the panel where piping is prohibited by code.

4.5.3 Concept Specifications. Provide outline specifications to be used for the project in accordance with CHAPTER A-11, SPECIFICATIONS. Where Savannah District or Unified Facilities Guide Specifications are to be used without change, a listing of the appropriate UFGS numbers will suffice. Where a departure or addition to a guide specification is required, include in listing a brief description of the equipment or procedure constituting the departure or addition.

Where no guide specification is available, prepare an outline specification from available criteria and instructions, giving all pertinent equipment and material characteristics.

4.5.4 Standard Drawings or Site Adaptations. Indicate all utility requirements as above and provide narrative and calculations for any other changes required for site adaptation or conformance to latest criteria. Design analysis, drawings, and specifications shall be updated to reflect the latest Sustainable Design and Energy Use Reduction requirements.

4.5.5 Field Investigation. The A-E shall make a complete and thorough field investigation prior to performing any design work on this project. This shall be done to verify conditions existing at the time of design compared to those shown on as-built drawings provided by the Project Manager. Any conflicts shall be reported to the Project Manager, Savannah District. The field investigation shall also determine the extent of mechanical renovation required in any existing building to accommodate the scope of this new project.

4.5.6 Boiler Permits. See paragraph 4.11.8 for boiler permitting requirements.

#### **4.6 PRELIMINARY (OVER THE SHOULDER) SUBMITTAL REQUIREMENTS**

If project specific instructions require this section, rather than section 4.7, the requirements identified in section 4.7 shall be submitted for this section, otherwise, there are no requirements for this section.

#### **4.7 PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS.**

4.7.1 General. When only Concept and Final Design submittals are required, the Final Design submittals shall contain all information developed in the Concept (35 Percent) Design Submittal Requirements, as well as that identified in this section (Preliminary (60 Percent) Design Submittal Requirements), and the Final (100 Percent) Design Submittal Requirements.

4.7.2 Preliminary Design Analysis.

4.7.2.1 The Preliminary Design Analysis will be a refinement of the Concept Design Analysis. All comments from this office relating to Concept design shall be incorporated in the Preliminary Design Analysis.

4.7.2.2 Base all new designs on the most economical plan consistent with the applicable publications listed in this manual. Cite the criteria references for all major design decisions.

4.7.2.3 Identify all references to standard texts, etc., for all major design decisions or assumptions not covered by criteria references.

4.7.2.4 All design analyses shall clearly show calculated capacities of all major items of mechanical equipment such as air handling units and coils, condensing units, water chillers, boilers, pumps, humidifiers, cooling towers, fans, hot water heaters and tanks. Pump heads will be estimated for preliminary design. Analyses shall show manufacturer's make and model number of equipment used for layout purposes, and shall show weights of major items of equipment. Include summaries of heating and cooling loads and, where applicable, show determination of water quantities and temperature rise or drop for hot water, chilled water, and condenser water. Show calculations for air on and off coils and develop air conditioning and/or



heating process cycles on a standard psychrometric chart, showing each air conditioning, heating, ventilation, humidification, and dehumidification system.

4.7.2.5 For Preliminary design, all piping inside the building and ductwork need not be sized based on detailed calculations, but should show estimated sizes sufficiently accurate to prepare the Preliminary Cost Estimate.

4.7.2.6 The Preliminary Design Analysis shall also include the following specific items, when applicable:

a. Heating, Ventilating, and Air Conditioning.

(1) Calculations for heating and cooling loads will be made in accordance with UFC and ASHRAE requirements. Computer-generated load calculations shall be used. Load calculation software must be ASHRAE-based and must be approved in advance by the Savannah District.

(2) Boiler sizes will be based on calculated heat load, safety factors, piping losses, and pickup requirements. Selection of boilers will be based on "gross" rating. List in design analysis allowances made for safety factors, piping losses, etc.

(3) Mechanical Ventilation. When calculating fan capacities for ventilation purposes, show in the analysis the volume of the space to be ventilated and the number of the air changes per hour used. If fan capacity is based on heat liberated in the space, show all assumptions made along with computations. All calculations required by ASHRAE Standard 62.1 shall be shown. This includes ventilation effectiveness and multiple space analysis if the ventilation rate procedure is used.

b. Outside Utilities.

(1) Exterior heating hot water, steam, chilled water, and natural gas distribution piping shall be sized for preliminary design. The analysis shall show flow quantities, pipe sizes, pressure drops per meter (or per 100 feet), total pressure drop, and initial and final pressures.

(2) Expansion Loop Calculations. Expansion loop sizes shall be calculated for heating hot water distribution systems. The entire distribution system shall be analyzed using a three-dimensional, finite element analysis program. Input, output and diagrams, indicating node locations shall be submitted. Loops shall provide adequate expansion on the straight runs of the system within the stress limits of ASME B31.1. Distance between guides on loops shall be equal to twice the width of the loop. Anchor distances shall not exceed 75 m (250 feet). Loops shall generally be formed of equal leg segments.

4.7.3 Preliminary Drawings. The Preliminary Drawings will be a refinement of the Concept Drawings. All comments from this office relating to Concept design shall be incorporated in the Preliminary Drawings. In addition, the Preliminary Drawings shall contain the following:

a. Floor plan layouts showing location and capacities of all items of mechanical equipment, piping, ductwork, and fixtures.

b. Enlarged plan of Mechanical Equipment Rooms. Equipment room layouts shall be sufficiently complete to show piping and duct layouts and access for maintenance. A minimum

of 900 mm (36 inches) working clearance shall be provided around all major equipment items when depicting the largest of three manufacturer's standard unit dimensions.

c. Layout (may be single line) of ductwork and piping inside of building including all items of mechanical equipment and fixtures. Detailed piping riser diagrams, sections, and elevations are not required for preliminary design unless required to show intent of design. Details and detailed piping schematic diagrams are required for preliminary design.

d. Equipment capacities shall be listed in the schedules. Minimum efficiency shall be included in the schedule for pumps. All major equipment shall have maximum kilowatts (horsepower) listed in the schedule. Coordinate electrical requirements with the electrical designer. Do not specify equipment by trade name.

e. Plumbing fixture schedule shall list individual fixtures and pipe size connections (cold water, hot water, waste, and vent).

f. Heating Hot water distribution plan showing location and sizes of lines and pits, pit equipment with capacities, anticipated grading of lines, and location and sizes of expansion loops and anchors.

g. Chilled water, domestic water, gas, and liquid fuel distribution plan showing location and size of distribution lines.

h. Any information other than the requirements listed above which the designer considers necessary to show the intent of design.

4.7.4 Preliminary Specifications. The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

4.7.4.1 Specifications will not be restrictive. Generally, the description will be such that at least three manufacturers can meet the specified requirements. Do not use trade names in the specifications.

4.7.5 Boiler Permits. See paragraph 4.11.8 for boiler permitting requirements.

## **4.8 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS**

4.8.1 General. When only Concept and Final Design submittals are required, the Final Design Submittals shall contain all information developed in the Concept (35 Percent) Design Submittal Requirements, as well as that identified in the Preliminary (60 Percent) Design Submittal Requirements, and the Final (100 Percent) Design Submittal Requirements.

4.8.2 Final Design Analysis.

4.8.2.1 The Final Design Analysis will be a refinement and completion of the Concept and/or Preliminary Design Analyses and shall contain all the information called for in paragraphs 4.5

and 4.7 of this chapter, even when preliminary submittal is not required. All comments from this office relating to Concept and Preliminary design shall be incorporated in the Final Design Analysis.

4.8.2.2 The design analysis will show applicable references for design assumptions not found in common reference manuals which were not listed during the Preliminary design stage.

4.8.2.3 All pipe sizing computations will be included in the analysis. Piping analyses will show design flow, pipe size, friction factors, slopes, lengths, and elevations where applicable, conducted quantity, and velocity in the various mains and branches. Where necessary, flow diagrams will be included in the analysis.

4.8.2.4 The determination of pump heads will be based on complete take off of friction losses and static heads.

4.8.2.5 The plumbing piping analysis will clearly show the main and branch loads in terms of "fixture units" as well as flow quantities L/min (gpm), supply pressure, and pressure available at all fixtures based on full flow conditions.

4.8.2.6 All duct sizing computations will be included in the analysis. Ductwork analyses will show friction loss and will clearly indicate the air velocities encountered in the main ducts. Where necessary, flow diagrams will be included in the analysis.

4.8.2.7 The determination of static pressure on fans and air handling units will be based on complete take off of static losses. The value should be calculated such that an allowance will be made for dirty filters. This value shall be included in the external pressure drop on the air handling unit schedule.

4.8.2.8 Heating, air conditioning, and ventilating analyses will include a summary sheet to show the final capacity of each piece of equipment including the manufacturer's make and model used for layout. The weight of each of the items of equipment will be included in this summary.

4.8.2.9 P.O.L. systems will be fully developed in accordance with project specific instructions when required.

#### 4.8.3 Final Drawings.

4.8.3.1 The Final Drawings will be a refinement and completion of Concept and/or Preliminary Drawings and shall contain all the information called for in paragraphs 4.5 and 4.7 of this chapter, even when preliminary submittal is not required. All comments from this office relating to Concept and Preliminary design shall be incorporated in the Final Drawings.

4.8.3.2 Where crowded conditions exist due to close proximity of other phases of the work, sufficient sections and elevations will be shown to indicate clearly the exact location of the particular item in relation to other items. As a minimum, one section will be taken through the most congested area of each mechanical room.

4.8.3.3 The number of elevations and details will be sufficient to allow construction and installation of the work without additional design work by the Contractor.

4.8.3.4 Where equipment connection details are shown, indicate all required valves, gauges, and fittings required. Coordinate with specification requirements and make sure that valves, fittings, etc., that are specified to be furnished with each piece of equipment are included in the detail.

4.8.3.5 Equipment room plans will clearly indicate by dotted lines, the space required for "tube pulling" on such items as boilers, chillers, condensers, etc. Sufficient room will be allowed for maintenance, coil removal, filter removal, etc., on other items of equipment. Space reserved by code at electrical panels shall also be shown.

4.8.3.6 Final plans shall show all pipe and duct sizes. Ductwork will be drawn to scale on plans. Catwalks, ladders, platforms, access panels, and doors required for operation and maintenance of equipment, valves, and accessories will be indicated on the drawings.

4.8.3.7 Performance characteristics for all items of mechanical equipment will be placed in carefully prepared equipment schedules. Equipment characteristics specified in "Note" fashion, or in random locations on the drawings are not acceptable. Equipment characteristics selected shall not be restrictive to any one manufacturer but must be competitive among at least three major manufacturers. No manufacturers' trade names shall be shown on the drawings.

4.8.3.8 Electrical characteristics will not be included in equipment schedules. Minimum efficiency shall be included in the schedule for pumps only. All other major equipment (1.1 kw or more) shall have maximum kilowatts (horsepower) listed in the schedule. See CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS.

4.8.3.9 Location of equipment, piping, and ductwork shall be completely coordinated with other features of the project - architectural, structural, electrical, etc.

4.8.3.10 Riser diagrams of soil, waste, drain, and vent stacks, and water risers will be shown on the drawings for all buildings two stories and higher.

4.8.3.11 Where critical, the air suction and discharge directions of such items as fans, air-cooled condensers, and cooling towers will be indicated on the drawings. Make sure that building fresh air intakes are located at a sufficient distance away from the air discharge of air-cooled condensing units, cooling towers, etc., as to preclude pick up of this air into the fresh air intake.

4.8.3.12 Heat distribution, liquid fuel distribution, and chilled water distribution drawings will have complete profiles for the entire length of run. These profiles will indicate elevations, depth of bury, and all interfering utilities which may be encountered. Details of pits, drip points, etc., will be shown. Where required to clearly define the requirements, profiles as specified above will be provided for natural gas distribution systems.

4.8.3.13 HVAC Controls. The Designer shall refer to CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS for HVAC Controls Final Design requirements. HVAC control system design shall be in accordance with the guidance presented in UFC 3-410-02. Coordinate with the appropriate Base Energy personnel for Base specific Controls requirements. Controls for boilers, chillers, and their auxiliaries located in central energy plants shall also be coordinated with the appropriate Base Energy personnel.

#### 4.8.4 Final Specifications.

4.8.4.1 Typed, fully edited project specifications shall be submitted in accordance with CHAPTER A-11, SPECIFICATIONS.

4.8.4.2 Specifications will not be restrictive. Generally, the description will be such that at least three manufacturers can meet the specified requirements. Do not use trade names in the specifications.

4.8.4.3 The subparagraphs on "Electrical Work" shall be carefully coordinated with the electrical section of the specifications. There shall be no conflicts as to which section covers starters, controls, or wiring, and no conflicts as to the type of starters required for the individual items of equipment.

4.8.4.4 The Designer shall refer to CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS, for specification requirements for HVAC Control Systems.

4.8.4.5 Particular care will be given to the compatibility of components, for example, the burner should suit the boiler; the combustion controls should suit the oil type and burner type selected.

#### 4.9 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**

4.9.1 Notice. In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

4.9.2 Compliance. The comments generated during the Final Design review shall be incorporated in the Corrected Final submittal.

#### 4.10 **REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP PACKAGES**

4.10.1 General. Unless indicated otherwise, RFP shall comply with the requirements of UFC 1-300-07A. Unless indicated otherwise, A-E shall be furnished an electronic format sample or template for the written technical requirements portion of the RFP to be edited for the specific project. The RFP shall describe the minimum proposal requirements.

4.10.1.1 Plumbing: RFP shall indicate that the plumbing systems shall be designed and installed in accordance with the International Plumbing Code.

4.10.1.2 Supply Air Plenums: RFP shall indicate that supply air plenums shall not be used unless approved by Savannah District.

4.10.1.3 Mechanical Systems Maintainability and Accessibility: RFP shall indicate that special attention shall be given to the maintainability and accessibility of all HVAC systems. Accessibility features (i.e. access panels, etc.) shall be designed and included as required to allow complete access to all mechanical systems and system components, which are

concealed, or require adjustment, inspection, maintenance, and replacement. Provide adequate clearance around all pieces of equipment for periodic maintenance, inspection, and cleaning. Service of one piece of equipment shall not require disturbance of adjacent equipment.

4.10.1.4 Commissioning: RFP shall indicate that Total Building Commissioning shall be required. The Savannah District will not serve as the Commissioning Authority, required under sustainable design.

4.10.1.5 Evaluation Factors: RFP shall address “evaluation factors” and indicate the order of relative importance of all factors evaluated. The A-E shall coordinate discussion of evaluation factors with the Savannah District Project Manager for guidance.

4.10.1.6 Proposer Submittal Requirements: As a minimum, RFP shall require the proposers to submit the following as part of their proposal:

a. Design Narrative: RFP shall require a design narrative describing the mechanical and plumbing system types proposed to be installed and description of air distribution, zoning, and control systems. The design narrative shall address all RFP issues and contain all explanatory material giving the design decisions that would not be obvious to an engineer reviewing the final drawings and specifications. The design narrative should also contain an outline of the specifications, sustainability checklists, and the indoor and outdoor design conditions.

b. Catalog Cuts: RFP shall address requirements for manufacturers catalog cuts for major pieces of equipment (air handlers, boilers, chillers, pumps over 5 hp) to be provided with submittal, that shall represent actual equipment proposed to be installed. RFP shall indicate that deviations and installation of equipment other than proposed will not be allowed or accepted unless approved by the Contracting Officer. RFP shall also indicate that proposed equipment shall be approved conditionally, pending its compliance with the specifications for the specific project.

4.10.1.7 Successful Proposer Submittal Requirements: As a minimum, for the remainder of the submittals for the successful proposer, the RFP shall require the successful proposer to submit Design Analysis, Drawings, Specifications, and any additional requirements in accordance with the Savannah District Design Manual for Military Construction, Chapter A-4.

4.10.2 Draft RFP Submittal. Submit the following:

a. The A-E shall provide design criteria, drawings, and an initial list of specifications for the RFP.

b. The A-E shall provide a narrative describing the mechanical and plumbing system types and description of air distribution, zoning, and control systems.

c. The A-E shall perform LCCAs (Life Cycle Cost Analysis) for HVAC system selection and for 30% solar thermal domestic hot water heating. HVAC system alternatives (air side) shall be submitted to Savannah District for approval. The system that wins out in the LCCA shall be documented in the RFP as the system to be designed around. Any other systems that come within 10% of the winning system in the LCCA shall also be documented in the RFP as potential systems to be designed around, pending the systems approval from the Savannah District.

#### 4.10.3 Final RFP Submittal.

4.10.3.1 Implement review submittal comments.

4.10.3.2 Verify consistency between plans, specifications, and corrections.

#### 4.11 TECHNICAL REQUIREMENTS

4.11.1 Statement of Work. Mechanical work includes, but is not limited to, the design of the following systems:

- a. Air Conditioning.
- b. Compressed Air.
- c. Emergency Engine-Generator Units.
- d. Natural Gas Distribution and Natural Gas Fittings.
- e. Heating.
- f. Hoists and Lifts.
- g. Incinerators.
- h. Ventilation for Equipment Rooms.
- i. Mechanical Equipment Spaces.
- j. Plumbing.
- k. Refrigeration.
- l. Chilled Water Distribution.
- m. Heating Hot Water and Steam Distribution.
- n. Liquid Fuel Storage, Distribution, and Dispensing.
- o. Seismic Protection.

4.11.2 Basic Technical Requirements. TI 800-01, ERs, and UFCs.

4.11.3 Coordination of Work.

4.11.3.1 Coordinate space requirements, foundations, supports, duct and pipe routing, electrical service, and the like for mechanical items with architectural, structural, and electrical design elements.

4.11.3.2 Coordinate exterior mechanical distribution systems with design elements handling other exterior utility designs and sitework.

4.11.3.3 All piping and ductwork will be concealed in habitable areas of all Army buildings, except storage or service facilities, as well as utility and medical storage spaces in hospitals.

4.11.4 Supplementary Technical Publications. Additional technical publications will be requested by the Designer for each project. These publications will supplement those cited in paragraph Basic Technical Requirements. In case of conflict between publications, the publications cited in paragraph Basic Technical Requirements will govern. See paragraph APPLICABLE PUBLICATIONS for a list of applicable Technical Publications.

4.11.5 Guide Specifications. The appropriate sections of guide specifications will be requested by the Designer initially and again at the Preliminary design stage for each project. The Designer shall read each before design is started and pay special attention to the TECHNICAL

NOTES included with each section of guide specifications. The specifications and notes reflect criteria that must be incorporated in the design.

#### 4.11.6 System Selection.

4.11.6.1 Full engineering considerations shall be given to achieve greater operating economics by the use of one or more of the several proven energy conservation systems. Several considerations to achieve energy conservation are described in Architectural and Engineering Instructions. See CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS.

4.11.6.2 The A-E shall evaluate the following design alternatives on a life cycle cost basis.

- a. Alternative domestic hot water heating systems.
- b. Extension of existing heating hot water, steam, or chilled water distribution systems to serve this facility versus self-contained systems.
- c. Building HVAC Systems Selection: The A-E shall carefully evaluate all of the project criteria and use good engineering judgement to select HVAC system alternatives which are compatible with the facility. A minimum of 3 viable alternatives shall be selected. The A-E shall contact Mechanical Section, Design Branch, for approval of alternatives to receive life cycle costing prior to computerized energy analysis as required by CHAPTER A-7, ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS.
- d. Providing the building with 30% solar thermal domestic hot water heating, or percent life cycle cost effective.

#### 4.11.7 Standard Systems Criteria.

##### 4.11.7.1 Air Conditioning.

4.11.7.1.1 Outside Design Conditions. Unless stated otherwise in Specific Instructions, outside design conditions shall be as required by UFC 3-410-01.

4.11.7.1.2 Inside Design Conditions. Unless stated otherwise in Specific Instructions, inside design conditions shall be as required by UFC 3-410-01.

4.11.7.1.3 Year-Round Cooling Requirements. If an air conditioning system serves areas having high internal heat gains (such as electronic equipment areas), considerations must be given to possible year-round cooling requirements and the system designed accordingly; this will include provisions for low ambient operation of air-cooled condensers; or if permitted, the use of an outside air economizer cycle. Provisions for reheating of supply air should be provided where justified.

4.11.7.1.4 Reliability, redundancy, and other requirements for air conditioning of Communications/Electronic installations shall be in accordance with I3A, TI 800-01, and UFCs..

4.11.7.1.5 Additional criteria required for proper design of special facilities will be given in specific instructions.



4.11.7.1.6 Air conditioned existing buildings, having attic spaces with insulation on the ceiling, shall be provided with mechanical ventilation to maintain a maximum of 5.56 degrees C (10 degrees F) above ambient in the attic space. No existing facility with attic space will be air-conditioned unless insulation is added to the ceiling to bring the roof/ceiling assembly thermal resistance factor into conformance with current criteria.

4.11.7.1.7 Automatic Heating and Cooling Changeover Controls. Outdoor sensing unit and controls shall be located where they will not sense heat generated by mechanical or electrical equipment. They shall not be located in the outside air intakes and exhaust air streams of mechanical equipment rooms where they can be affected. Automatic changeover is permitted where there is a building central heating and air conditioning system, provided the changeover control is based on sensing outside air temperatures. When automatic changeover controls are used the building piping system shall contain a control loop. When changeover takes place, the control loop will allow the water in the piping system to continue circulating in order for it to become a neutral temperature before it enters the equipment (boiler or chiller). Having the water at a neutral temperature before it enters the equipment (boiler or chiller) will prevent thermal shock of the equipment (boiler or chiller).

4.11.7.1.8 Fire Protection. The current requirements of NFPA 90A and 90B will be incorporated in all heating and air conditioning systems designs except that corridors shall not be used as a supply, return, or exhaust air plenum in any type of occupancy.

4.11.7.1.9 Noise and Vibration Control. All noise control design work shall be in accordance with UFC 3-450-01 and ASHRAE requirements.

4.11.7.1.10 Ductwork Design. Ductwork shall be designed in accordance with ASHRAE recommendations and applicable SMACNA standards. Variable air volume systems shall have ducts sized by the Static Regain Method.

4.11.7.1.11 For Air Force projects, a "kJ" ("Btu") meter shall be provided at the point of entry for any new building or major building renovation that is to be served from a central chilled water plant. The meter shall be commercially available and sense chilled waterflow and temperature differential from which it shall automatically calculate and record Btu's.

4.11.7.1.12 Humid Areas. Reference UFC 3-410-01, for additional requirements for humid areas.

4.11.7.1.13 Filtration. For all air handling units serving occupied spaces, filter the combined supply air, including return and outside air, using a combination of 30 percent efficient prefilter(s) and 80 to 85 percent efficient final filter(s). Where practical, provide separate filtration or other means to clean the outdoor air, typically equivalent to that used for the combined air stream, prior to mixing it with the return air. Separate filtration for the outdoor air will reduce the contaminants in the outdoors from entering the primary air stream. Even in areas where the outdoor air is seemingly clean, low levels of auto emissions, pollen, dust, etc., can accumulate on the interior of ductwork and plenums and later cause inadequate air quality problems. Due to the decrease in system airflow as the pressure drop across the filter increases, size fans for the "dirty" filter condition. This will ensure that each fan has adequate capacity to deliver the design airflow as the filter becomes loaded.

4.11.7.2 Compressed Air. Unless requirements are stated in Specific Instructions, compressed air system and compressor sizes will be determined by the Designer from analysis of equipment layout and/or coordination with using service requirements.

#### 4.11.7.3 Emergency Engine-Generator Units.

4.11.7.3.1 General. This feature must be coordinated with the electrical design element. A single set of specifications will be prepared to specify the unit and auxiliary equipment. The Mechanical Designer shall be responsible for plans and specifications covering the engine, fuel system, exhaust, and cooling system. The electrical designer will be responsible for the design and specification of the generator and other electrical appurtenances and controls. If a gasoline engine is used, the design shall conform to applicable NFPA codes; i.e., fueling systems, hazardous area classification, etc.

4.11.7.3.2 Ventilation for Emergency Engine-Generator Rooms. The ventilating air quantity shall be sufficient to hold the room temperature at approximately 48.9 degrees C (120 degrees F.) with a maximum of 51.67 degrees C (125 degrees F). The following heat dissipation rates will be used in calculating ventilation rate:

- a. Heat given off by generator and exciter - 188 W/kW (8 Btu per minute per HP).
- b. Heat given off by engine surfaces (either dry or water-cooled manifold) - 235 W/kW (10 Btu per minute per HP).
- c. Heat given off by exhaust system - Initial surface temperatures of 415 C - 510 C (780 degrees F. to 950 degrees F.) for engines with water-cooled manifolds.

4.11.7.4 Natural Gas Distribution and Natural Gas Fittings. Natural Gas distribution system will extend from point of connection with existing main to a point 1.5 m (5 feet) from the building. Natural Gas fitting connects at the 1.5 m (5-foot) mark and covers all interior gas piping. The system will be designed such that there will be no exposed gas lines or meters in the front of the facility, and coordinated with the User.

#### 4.11.7.5 Heating.

4.11.7.5.1 Outside Design Conditions. Unless stated otherwise in Specific Instructions, outside design conditions shall be as required by UFC 3-410-01.

4.11.7.5.2 Inside Design Conditions. Unless stated otherwise in Specific Instructions, inside design conditions shall be as required by UFC 3-410-01.

4.11.7.5.3 Energy Source Selection. Energy Source selection shall be based on criteria contained in Chapters A-5 and A-7 of this manual.

#### 4.11.7.6 Hoists and Lifts.

4.11.7.6.1 Hoists. The mechanical designer shall determine lifting and travel speeds for motor operated hoists, trolleys, and cranes. The determinations shall be based on job requirements and will be in conformance with standard catalog products of at least three reputable manufacturers. Electrical requirements will be coordinated with electrical drawings. Monorail supports will be designed by the structural engineer and shown on structural drawings.

4.11.7.6.2 Lifts. Automotive lifts shall conform to the latest issue of ANSI/ALI ALCTV Standard for Automotive Lifts - Safety Requirements for the Construction, Testing, and Validation. The lift will be detailed on the drawings. Show on the drawings the necessary control dimensions such as lift center line and location of front of lift with respect to building wall. Also, show drainage piping which will connect pit drainage to building.

#### 4.11.7.8 Ventilation for Equipment Rooms.

4.11.7.8.1 Refrigerant Compressor Rooms for Walk-in and Reach-in Refrigerators. Air-cooled condensing units with integral condensers will be provided with not less than 500 L/s of air per kW (800 CFM of air per horsepower) (nameplate rating). Water-cooled condensers and remote air-cooled condensers will be provided with not less than 50 L/s of air per kW (80 CFM of air per horsepower) (nameplate rating). Compressor rooms will be provided with outside air intake louvers and thermostatically controlled exhaust fans.

4.11.7.8.2 Mechanical equipment rooms will usually be ventilated using outside air intake louvers and a thermostatically controlled exhaust fan. Use a supply fan in lieu of an exhaust fan in rooms where atmospheric burners are located. The ventilation fan will have a two-speed motor, that is sized, at the high speed, to have adequate capacity to limit the room dry bulb temperature to a maximum of 6 degrees C (10 degrees F) above the outdoor dry bulb temperature when both equipment and ambient loads are at their maximum peaks. The high speed will be activated 6 degrees C (10 degrees F) below the maximum temperature at which the most sensitive item of equipment in the room can operate. The low speed will operate at 11 degrees C (20 degrees F) below that of the high speed.

4.11.7.8.3 Gas-fired Furnaces. The following NFPA 54 guidance will be used:

a. Provide combustion air as required by two permanent openings to the outside. Openings will communicate directly, or by duct, to the outside. One opening will be within 300 mm (12 inches) of the top of the Furnace Room and one opening will be within 300 mm (12 inches) of the bottom of the Furnace Room. Openings directly to the outside or ducted vertically to the outside will give a minimum free area of 11 mm<sup>2</sup> per 20 W (1 square inch per 4,000 BTUH) input rating for all equipment. Openings ducted horizontally to the outside will have a minimum free area of 11 mm<sup>2</sup> per 10 W (1 square inch per 2,000 BTUH) input rating.

b. All return air will be ducted to the furnace. The furnace room will not be used as a return.

4.11.7.9 Mechanical Equipment Spaces. Mechanical equipment (sized from three manufacturers), piping, and accessories in boiler and equipment rooms will be drawn to scale on the drawings in both plan and elevations. Adequate space will be provided for maintenance, operation, and replacement of equipment, piping, and accessories. Catwalks, ladders, platforms, access panels, and doors required for operation and maintenance of equipment, valves, and accessories will also be indicated and detailed on the drawings.

#### 4.11.7.10 Plumbing.

4.11.7.10.1 Wall Hydrants and Lawn Faucets. The maximum spacing between wall hydrants or between lawn faucets around the perimeter of a building is 60 m (200 feet). Add 18 L/min (5 gpm) for each hydrant or faucet to building load for sizing water main. No diversity will be assumed.

4.11.7.10.2 Roof Drainage. Gutters and exterior downspouts will be sized by architectural design element, shown on the architectural drawings, and specified in architectural sections of the specifications. Roof drains and interior downspouts, including collection system, shall be sized by mechanical designer, shown on the mechanical drawings, and specified in the plumbing section of the mechanical specifications.

4.11.7.10.3 Wash Rack Drainage Facility. All wash racks shall be provided with suitable grease and sediment traps. The effluent from wash racks shall be provided with grit chambers and oil separators. The wash rack effluent will be discharged into storm drains or sanitary sewers as required by E.P.A. regulations.

4.11.7.10.4 Design for the Physically Handicapped. Appropriate modifications to plumbing fixtures, as required by Uniform Federal Accessibility Standard (UFAS), shall be included in all projects designated to be suitable for access by the physically handicapped.

4.11.7.10.5 Domestic Hot Water Temperature.

a. Domestic hot water supply maximum temperatures at the point of use will be as required in UFC 3-420-01 unless higher temperatures are required for sanitizing and special processes.

b. Design guidance in UFC 3-420-01 and ASHRAE shall be followed.

4.11.7.10.6 Connection of Potable Water Supply with Utility Systems Having Chemical Treatment Facilities. When a potable water supply is connected with a utility system such as heating hot water system, chilled water system, or cooling tower, which is equipped with chemical treatment facilities, a reduced pressure principle backflow prevention device shall be provided. The positive break should occur between the potable water supply and the utility system. The drain line from the backflow assembly shall be run to a floor drain. The backflow assembly shall not be installed over 1500 mm (5 feet) above the floor for maintenance access.

4.11.7.11 Refrigeration.

4.11.7.11.1 Coordinate walk-in cooler and refrigerated space requirements with architectural drawings.

4.11.7.11.2 Provide defrost and drainage facilities for units.

4.11.7.11.3 Provide ample ventilation for compressor rooms as hereinbefore specified in paragraph 4.11.7.8.1.

4.11.7.12 Chilled Water Distribution. The chilled water distribution system will extend from connection to existing exterior mains to a point approximately 600 mm (2 feet) inside the mechanical equipment room where both the supply and return lines shall terminate with shutoff valves. The building chilled water system will connect to the distribution system at this point. A valved bypass will be installed on the distribution side of the shutoff valves. The amount of distribution piping between the equipment room wall or floor and the shutoff valves will be held to a minimum but will be of sufficient length to allow installation of the bypass.

4.11.7.12.1 Air-Cooled Chillers. All air-cooled chillers shall comply with the following requirement: Unless the condenser coil is completely protected through inherent design,

louvered panel coil guards shall be provided by the manufacturer to prevent physical damage to the coil.

4.11.7.13 Heating Hot Water and Steam Distribution. The Heating Hot Water and Steam distribution systems will extend from connection to existing exterior mains to a point approximately 600 mm (2 feet) inside the mechanical equipment room where both the supply and return lines shall terminate with shutoff valves. The building systems will connect to the distribution system at this point. For heating hot water systems, a valved bypass will be installed on the distribution side of the shutoff valves. The amount of distribution piping between the equipment room wall or floor and the shutoff valves will be held to a minimum but will be of sufficient length to allow installation of the bypass. High Temperature Heating Hot Water and Steam distribution systems shall enter the mechanical equipment room in close proximity to an exterior door to allow easy access to the shutoff valves from the door.

4.11.7.14 Liquid Fuel Storage, Distribution, and Dispensing.

4.11.7.14.1 In accordance with Air Pollution Abatement (Environmental) Policy, the following requirements will apply:

a. Fuel tanks of 151,416 L (40,000 gallon) capacity or more for storing gasoline or other organic liquids with a vapor pressure of 10.34 kPa (1.5 psi) absolute or greater under actual storage conditions shall either be of nonvented construction, designed for maximum pressure expected, or else equipped with floating roof or a vapor recovery system.

b. Stationary gasoline storage tanks of 900 L (240 gallons) or more shall be equipped with either submerged filling inlets or with vapor recovery systems such that loss of vapor to the atmosphere during filling operations shall be minimized.

c. Gasoline or petroleum distillate tank car or truck loading facilities handling 75,708 L (20,000 gallons) per day or more shall be equipped with submersible filling arms or other vapor emission control systems.

4.11.7.14.2 Aviation fuel tanks of steel construction will be interior lined with an epoxy coating system conforming to US DOD QPL-4556-28, Coating Kit, Epoxy, for Interior of Steel Fuel Tanks, minimum thickness of two coats, 0.15 mm (6 mils). Interior metal surfaces will be sandblasted to bright metal prior to coating, in accordance with the requirements of "Steel Structure Painting Council Surface Preparation Specification," SSPC-SP 5/NACE No. 1. Work must be accomplished by experienced lining applicators.

4.11.7.15 Seismic Protection. All projects will include appropriate provision for protection of mechanical piping, equipment, and underground utilities against damage from seismic events in accordance with UFC requirements. Generally, these requirements can be satisfied by the inclusion of the appropriate Unified Facilities Guide Specification section(s), in the contract specifications.

4.11.7.16 Other Systems. Other systems are required for special projects such as medical and industrial type facilities. These will be designed in accordance with the Specific Instructions issued for each project of this type.

4.11.8 Boiler Permits.

4.11.8.1 Pursuant to satisfying requirements under the Clean Air Act, at or before the 60 percent design stage, the A-E shall submit to the installation's environmental office 1) a listing of boilers and domestic hot water heaters that will be fired by natural gas, propane, and/or fuel oil, 2) the fuel or fuels (primary and backup, if applicable) that will be utilized for each piece of equipment, 3) the quantity of each particular size, and 4) the respective input firing rate. The document shall also provide a point of contact and an alternate point of contact, should the environmental office require additional information from the designer of record during the permitting process. Furthermore, two copies of the document shall also be sent to the Savannah District, one to the Project Manager for placement in Central Files, and another to the Mechanical Section.

4.11.8.2 This document shall not be sent prematurely, since any increase in boiler sizing subsequent to submission of the document will require revision to the permitting process. In any event, if there is a change in equipment sizing during refinement of the design process, an updated copy of said document shall be submitted per the guidance above.

4.11.8.3 Additionally, the A-E is responsible for incorporating into the design the equipment accessories required for compliance with the governing environmental laws. This includes, but is not limited to, determining the need for individual metering and the level of emissions monitoring required. The A-E's concept design narrative shall specifically address those features that will be incorporated into the boiler system design to assure compliance with the applicable environmental laws of the state.

4.11.8.4 Normally, for fast track design-build contracts, the construction permit will not have been obtained prior to award of the design-build contract. No construction associated with the building(s) housing the boiler(s) or other source(s) of contaminant can be done prior to obtaining the required permit. Generally, only the following things can be done prior to possession of the permit: clearing and grading, access roads, driveways, parking lots, underground utilities up to the five foot line of the buildings, and ancillary structures (structures not associated with housing the sources of contaminants). A-E developed requests for proposals (RFPs) for fast track construction shall contain the language necessary to convey this fact to proposers.

4.11.9 Sustainable Design. The design shall comply with the energy and water savings requirements provided in Chapter A-14 of the Savannah District Design Manual for Military Construction, Sustainable Design.

4.11.10 Energy Policy Act of 2005 (Public Law 109-58). The A-E shall provide documentation of compliance with the Energy Policy Act of 2005, as part of their design submittals.

4.11.11 Energy Independence and Security Act of 2007. The A-E shall provide documentation of compliance with the EISA 2007, as part of their design submittals.

4.11.12 ASHRAE 189.1. The A-E shall provide documentation of compliance with the applicable portions of ASHRAE 189.1, as part of their design submittals.

\*\*\* End of Section \*\*\*

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- 5.8.3 Final (100%) Design Analysis

- 5.8.4 Final (100%) Design Drawings
- 5.8.5 Final (100%) Design Specifications
- 5.8.6 Final (100%) Design Certifications

## **5.9 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**

### **5.10 REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP'S**

- 5.10.1 General
- 5.10.2 Project Requirements
- 5.10.3 Coordination
- 5.10.4 Draft RFP Submittal Requirements
- 5.10.5 Final RFP Submittal Requiremen



## CHAPTER A-5

### ELECTRICAL POWER, LIGHTING, GROUNDING, COMMUNICATIONS AND ALARM SYSTEMS

#### 5.1 GENERAL

This chapter gives general guidance for the preparation of drawings, specifications, and design analyses of electrical systems, including but not limited to normal power, emergency power, lightning protection, grounding, lighting, telecommunications, electronic security, audio/visual, public address, fire alarm and mass notification systems. The purpose is to provide guidance for preparing accurate and complete electrical designs that are cost effective, energy efficient and inherently reliable and safe. The design of electrical systems shall be in accordance with UFC 3-501-01 (Electrical Engineering), and other applicable publications.

#### 5.2 APPLICABLE CRITERIA

The most current editions of the criteria applicable at the time of contract issuance or otherwise defined in the contract shall be used. The criteria listed below includes commonly referenced criteria. The listed criteria in not all-inclusive.

##### 5.2.1 Unified Facilities Criteria (UFC)

UFC 1-200-02	High Performance and Sustainable Building Requirements
UFC 1-300-07A	Design Build Technical Requirements
UFC 3-490-06	Elevators
UFC 3-501-01	Electrical Engineering
UFC 3-520-01	Interior Electrical Systems
UFC 3-520-05	Stationary and Mission Batteries
UFC 3-530-01	Design: Interior and Exterior Lighting and Controls
UFC 3-540-01	Engine-Driven Generator Systems for Prima and Standby Power Applications
UFC 3-550-01	Exterior Electrical Power Distribution
UFC 3-570-01	Cathodic Protection
UFC 3-575-01	Lightning and Static Electricity Protection Systems
UFC 3-580-01	Telecommunications Building Cabling Systems Planning and Design

UFC 3-600-01	Fire Protection Engineering for Facilities
UFC 4-010-01	DoD Minimum Antiterrorism Standards for Buildings
UFC 4-010-05	Sensitive Compartmented Information Facilities Planning, Design, and Construction
UFC 4-010-06	Cybersecurity of Facility-Related Control Systems
UFC 4-021-01	Design and O&M: Mass Notification Systems
UFC 4-021-02	Electronic Security Systems
UFC 4-510-01	Design: Military Medical Facilities

#### 5.2.2 Army Criteria

AR 190-11	Physical Security of Arms, Ammunition, and Explosives
TC I3A	Technical Criteria for Installation Information Infrastructure Architecture (Outside Plant Only)
SIPRNET TC	Secret Internet Protocol Router Network (SIPRNET) Technical Implementation Criteria (FOUO; contact USACE Project Manager for access.)

#### 5.2.3 USACE Engineering and Construction Bulletin (ECB) Criteria

ECB 2018-17	New Requirements for Visual Notification for Mass Notification Systems
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#### 5.2.4 Committee on National Security Systems Criteria

CNSSAM TEMPEST/1-13	Red/Black Installation Guidance (FOUO; contact USACE Project Manager for access.)
CNSSI 7003	Protected Distribution Systems

#### 5.2.5 National Counterintelligence and Security Center

IC Tech Spec For ICD/ICS 705	Technical Specification for Construction and Management of Sensitive Compartmented Information Facilities (SCIF)
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#### 5.2.6 Industry Criteria

ANSI C2	National Electrical Safety Code
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ASHRAE 90.1	Energy Standard for Buildings Except Low- Rise Residential Buildings
IES G-1	Guide for Security Lighting for People, Property, and Critical Infrastructure
IES HBK	Lighting Handbook Reference and Application
IES RP-1	Recommended Practice for Office Lighting
IES RP-3	American National Standard Practice on Lighting for Educational Facilities
IES RP-7	Recommended Practice for Lighting Industrial Facilities
IES RP-8	Recommended Practice for Lighting Roadway and Parking Facilities
IES RP-33	Lighting for Exterior Environments
NACE SP0169	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
NFPA 780	Standard for the Installation of Lightning Protection Systems
TIA 568.0-D	Generic Telecommunications Cabling for Customer Premises
TIA 568.1-D	Commercial Building Telecommunications Cabling Standard
TIA 568.2-D	Balanced Twisted-Pair Telecommunications Cabling and Components Standard
TIA 568.3-D	Optical Fiber Cabling Components
TIA 569-D	Telecommunications Pathways and Spaces
TIA 606-C	Administration Standard for Telecommunications Infrastructure
TIA 607-C	Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
TIA 758-B	Customer-Owned Outside Plant Telecommunications Infrastructure Standard

UL 96A	Installation Requirements for Lightning Protection Systems
USAB	Uniform Federal Accessibility Standards (UFAS)
USGBC LEED v4	Building Design and Construction (BD&C)

### **5.3 PRECONCEPT SUBMITTAL REQUIREMENTS**

There are no electrical requirements for this submittal.

### **5.4 CODE 3 DESIGN REQUIREMENTS**

Project specific requirements will be provided with specific instructions to the contract or delivery order.

### **5.5 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS**

#### 5.5.1 Concept Design Narrative

5.5.1.1 Design Criteria. Provide a comprehensive list of applicable criteria for all electrical systems included in the scope of work.

#### 5.5.1.2 General

Briefly describe the electrical scope of work for the project, including but not limited to normal power, emergency power, lightning protection, grounding, lighting, telecommunications, electronic security, audio/visual, public address, fire alarm and mass notification systems.

#### 5.5.1.3 Site Power

a. Coordination. Provide documentation demonstrating coordination with the Army DPW, Air Force BCE or privatized utility as applicable. Provide names, phone numbers and email addresses for all people contacted and guidance received. Address the adequacy of the existing primary service and identify the point of connection. Where the primary service is determined to be inadequate, address measures to correct the deficiency. Where the primary service is owned and/or maintained by a privatized utility, clearly define the demarcation point between the responsibilities of the utility and the contractor, and describe the roles of the utility and the contractor in extending service to the facility.

b. Primary Power Characteristics. Identify the primary power characteristics (voltage, phase, and number and size conductors) of Government owned lines. Indicate all demolition, relocation or addition to the primary lines.

c. Secondary Power Characteristics. Identify the secondary power characteristics (voltage, phase, and number and size conductors). Indicate all demolition, relocation or

addition to the primary lines. State the basis for the selected service voltage (480Y/277 or 208Y/120). Indicate if the secondary conductors will be aerial or underground.

d. Conductor Material. Identify the conductor material (e.g., copper or aluminum) to be used for both primary and secondary services. Where materials are mixed, explain why they are being mixed and identify where each material will be used.

e. Estimated Loads. Estimate the kVA demand load for the building service, and provide the basis for the estimates. Indicate type, number, and kVA capacity of transformer installation proposed. State the primary and secondary connection of transformers (i.e. 12470 to 480Y/277 volts, delta-wye).

f. Generator Power. Identify the requirements for generator power. Indicate if the generator will be permanently installed or if provisions will be made for a GFGI portable generator. Indicate the purpose for the generator, such as complete building coverage or isolated loads, and identify applicable code requirements (e.g., NEC Article 700, 701 or 702). Confirm CFCI generators are authorized by the project DD Form 1391.

#### 5.5.1.4 Site Lighting

a. Coordination. Provide documentation demonstrating coordination with the Army DPW, Air Force BCE or privatized utility as applicable. Provide names, phone numbers and email addresses for all people contacted and guidance received. Address installation specific lighting requirements. Where site lighting is owned and/or maintained by a privatized utility, clearly define the responsibilities of the utility and the contractor.

b. Description. Provide a statement describing roadway, security, parking, and walkway lighting requirements. Indicate luminaire types, pole types, pole heights and proposed lighting intensities. Identify the ASHRAE 90.1 Exterior Lighting Zone for the project.

c. Controls. Indicate the proposed site lighting controls and identify the governing criteria (e.g., ASHRAE 90.1).

#### 5.5.1.5 Site Communications

a. Coordination. Provide documentation demonstrating coordination with the Army Network Enterprise Center (NEC) or Air Force Base Communication Office (BCO) as applicable. Provide names, phone numbers and email addresses for all people contacted and guidance received. Address the adequacy of the existing lines and identify the point of connection. Where the communication lines are determined to be inadequate, address measures to correct the deficiency. Address installation specific site communication requirements.

b. Description. Indicate if new lines will be aerial or underground and indicate the copper pair and/or fiber strand quantities. Provide the basis for the quantities.

#### 5.5.1.6 Site Cable Television (CATV)

a. Coordination. Provide documentation demonstrating coordination with the installation CATV service provider. Provide names, phone numbers and email addresses for all people contacted and guidance received. Address new infrastructure requirements and clearly define the responsibilities of the CATV service provider and the contractor.

b. Description. Identify the location of new head-end equipment. Indicate if final terminations will be made by the CATV service provider or the contractor.

#### 5.5.1.7 Cathodic Protection

Address corrosion control for underground metallic structures, piping, fittings, and valves. Where cathodic protection is required by criteria or project instructions, inform the Savannah District project manager if resistivity measurements are necessary and specify the testing methods, testing locations, ground rod lengths, and other information required for the resistivity measurements. Savannah District Soils Section will perform all resistivity measurements required to design corrosion control and grounding systems. For additional information, see Chapter A-0-2, SOILS.

#### 5.5.1.8 Interior Electrical Systems

a. Service Equipment. Describe the selected service entrance equipment (e.g., switchboard, panelboard) and provide justification for the selection. Estimate the ampere rating of the service entrance equipment and estimate the size and quantity of service entrance conductors.

b. Special Power Requirements. Provide a brief description of special items of design such as dc power systems, 400 Hz power systems, Uninterruptible Power Supplies (UPS), motor control centers or special purpose receptacles. Identify the associated electrical characteristics (e.g., volts, phase, and amps). Reference the applicable NEMA configuration or other recognized standards to identify special receptacles.

c. Conduit and Wiring. Indicate the proposed type of conduit and wiring system (e.g., RMC, IMC, EMT and NMC) and indicate where each type is intended to be used.

d. Lighting. Provide a brief description of the lighting systems. Include a list of lighting parameters for each room, identifying the room name and number and the corresponding lighting control space type per ASHRAE 90.1. The list shall include the proposed luminaire type, target illumination level, target illumination basis (e.g., IES Handbook, UFC) and special requirements (e.g. A/V interface, daylight harvesting, NSF rating). Light sources shall typically be solid state (LED). Provide justification for any spaces in which other light sources are proposed.

e. Emergency and Egress Lighting. Provide a brief description of the emergency lighting systems. Identify proposed emergency lighting sources (e.g., generator, inverter, emergency driver). Address NFPA 101 requirements for interfacing the egress lighting controls with the building fire alarm system.

f. Hazardous (NEC Classified) Locations. Identify hazardous locations by class, division and group as defined in NFPA 70. Indicate the boundaries of the hazardous locations and identify equipment proposed to be located in the locations.

g. Seismic Design. Indicate the seismic design category as defined in UFC 3-301-01, and address seismic bracing and anchors applicable to electrical conduit, cable trays and equipment. (Seismic design categories for which seismic protection is not required are addressed in General Note, Part 1, UFGS Section 26 05 48.00 10.)

#### 5.5.1.9 Lightning Protection System

Perform an NFPA 780 Lightning Risk Assessment and indicate if the assessment recommends a lightning protection system. State if a lightning protection system will be provided. Provide justification for providing a lightning protection system when not recommended by the assessment, or for not providing a lightning protection system when recommended by the assessment.

#### 5.5.1.10 Metering

Describe electrical metering equipment to be provided, indicate if the outputs are to be transmitted to the Base EMCS system and the method of transmission. Address LEED and ASHRAE 90.1 metering requirements as applicable. As a minimum, metering shall be provided in compliance with LEED EA Prerequisite: Building Level Energy Metering.

#### 5.5.1.11 Fire Alarm and Mass Notification System

a. Coordination. Provide documentation demonstrating coordination with the installation Fire Department. Provide names, phone numbers and email addresses for all people contacted. Document any special guidance received.

b. Describe the type of fire alarm and detection system and the mass notification system. Include a list of required devices. Include any compatibility issues that may occur when connecting to the installation system. Indicate if the mass notification system will be used for public address.

#### 5.5.1.12 Interior Communications

a. Coordination. Provide documentation demonstrating coordination with the Army Network Enterprise Center (NEC) or Air Force Base Communication Office (BCO) as applicable. Provide names, phone numbers and email addresses for all people contacted. Address installation specific communication requirements.

b. Voice. Describe the telephone system requirements including the type system, the type of instruments and the size of the installation including stations, trunk size, connection to and location of switch.

c. Data. Describe the data system requirements including the type of cable, type of instruments, and the size of the installation, including stations, trunk size, connection to

and location of switch. Identify SIPRNET requirements and other secure or specialized network requirements.

#### 5.5.1.13 Interior Cable Television (CATV)

a. Coordination. Provide documentation demonstrating coordination with the CATV service provider and the Army Network Enterprise Center (NEC) or Air Force Base Communication Office (BCO) as applicable.

b. Description. Describe the CATV system. Indicate the proposed location of the head-end equipment and include a description of the infrastructure required. Identify all requirements for the facility system to interface with the existing installation system. Indicate if final terminations will be made by the CATV service provider or the contractor.

#### 5.5.1.14 Special Systems

a. Coordination. Provide documentation demonstrating coordination with the installation Physical Security Office. Provide names, phone numbers and email addresses for all people contacted and guidance received.

b. Description. Describe all special systems, including public address, access control, intrusion detection, door monitor, video surveillance and intrusion detection systems. Indicate which systems include equipment and which are limited to infrastructure.

#### 5.5.1.15 Renewable Energy Systems

Address the life-cycle cost effectiveness of providing on-site renewable energy. Where provided, describe the proposed renewable energy systems and indicate the anticipated power generation. Identify the interface with the utility system where applicable. Provide documentation demonstrating coordination with the Army DPW, Air Force BCE or privatized utility as applicable. Provide names, phone numbers and email addresses for all people contacted and guidance received.

#### 5.5.1.16 Renovation and Additions

a. Field Trip Report. Describe the extent of the renovation, detailing all electrical material proposed to be re-used. Provide a Field Trip Report with photographs documenting the condition of existing equipment and identifying all equipment intended for reuse. Include records of meetings held with facility personnel, including participant lists. Document all agreements or understandings reached with facility personnel, and identify any unforeseen site/building conditions.

b. Expansion. Identify all existing systems proposed to be expanded or altered, and verify the system can accommodate the proposed changes.

c. Existing Loads. Address the methodology used to determine existing loads. Reference as-built drawings or historic demand data as applicable, and address NFPA 72 constraints on the use of historic data.



#### 5.5.1.17 Sustainability

Describe the project sustainability requirements. Army projects typically require LEED certification, whereas Air Force projects typically require third party certification under Guiding Principles .For projects requiring LEED v4 certification, indicate which credits will be attempted by the electrical design. As a minimum, address the following prerequisites and credits: SS Credit Light Pollution Reduction, EA Prerequisite Minimum Energy Performance, EA Prerequisite Building-Level Energy Metering, EA Credit Advanced Energy Metering, EA Credit Demand Response and EQ Credit Interior Lighting. For additional information, see Chapter A-14, SUSTAINABLE DESIGN.

#### 5.5.1.18 Cybersecurity

Describe the cybersecurity requirements for all facility-related control systems. Typical systems to be addressed include Fire Alarm & Mass Notification Systems (FA/MNS), Heating Ventilation & Air Conditioning Systems (HVAC), Electronic Security Systems (ESS) and Lighting Control Systems. For each system, indicate the Confidentiality, Integrity and Availability (C-I-A) impact levels (Low, Moderate or High). Identify the Authorizing Official and System Owner, and provide names, phone numbers and email addresses for all people contacted and guidance received.

#### 5.5.1.19 Unique Requirements

Describe the electrical requirements of all special areas with unique electrical features, such as Sensitive Compartmented Facilities (SCIFs), Server Rooms and Arms Rooms.

### 5.5.2 Concept Design Analysis

5.5.2.1 Electrical Load Estimate. Provide an estimate of the total connected load (kVA), total demand load (kVA), transformer size and service size.

5.5.2.2 Lightning Protection. Provide a Lightning Protection Risk Assessment in accordance with NFPA 780, and provide a recommendation regarding the need for lightning protection.

5.5.2.3 Exterior Lighting Calculations. Point-by-point lighting calculations are not required for this submittal. Rule of thumb calculations (i.e. 1:4 pole height-to- pole spacing ratio) may be used.

### 5.5.3 Concept Design Drawings

5.5.3.1 Site Electrical Plan. Provide a dedicated site electrical demolition plan where applicable, and a dedicated site electrical plan. Show existing to remain, existing to be demolished and new electrical and communications lines and equipment, including manholes, poles, transformers, primary switches and generators, as applicable. Clearly distinguish between the existing and proposed work. Identify the demarcation point(s) between the Contractor's scope of work and any work provided by the Installation or Privatized Utilities. Provide a layout for any exterior lighting included in the project.

a. Power Lines. Provide electrical characteristics (voltage, phase, number and size of conductors/conduits) for the primary and secondary lines at the points of delivery and/or extensions. Clearly identify the points of connections.

b. Power Equipment. Indicate transformer ratings (e.g., primary and secondary voltages, KVA size) and generator ratings (e.g., voltage, kVA/kW size).

c. Lighting. Provide a luminaire schedule indicating luminaire types, luminaire wattages, pole types and pole heights for all CFCI luminaires.

d. Communication and CATV Lines. Indicate the types and quantities of copper, fiber and CATV cables serving the facility. Clearly identify the points of connections.

5.5.3.2 Interior Communication Plan. Provide dedicated communication plans with legend showing the room names and outlet locations for voice, data, and CATV.

5.5.3.3 Interior Special Systems Plan. Provide dedicated special systems plans with legend showing the room names and proposed locations for special systems devices and head-end equipment. All special systems identified in the project DD Form 1391 (e.g., intrusion detection system (IDS), access control system (ACS), video surveillance system (CCTV), etc.) shall be indicated on the plans and included in the electrical design scope of work. The special systems plan may be combined with the communications plan where clarity is not compromised.

5.5.3.4 Interior Demolition Plan. Provide dedicated demolition plans showing all electrical demolition and relocation where applicable. Demolition may be shown on plans with new work where demolition is minor and clarity is not compromised.

#### 5.5.4 Concept Design Specifications

No specifications are required.

### **5.6 PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS**

#### 5.6.1 Review Comments.

Evaluate the Concept Submittal review comments and incorporate all approved comments into the design.

#### 5.6.2 Preliminary (60%) Design Narrative

The Preliminary (60%) Design Narrative shall include all of the requirements of the Concept Design Narrative. The narrative shall include any revised or updated information, as well as any additional information obtained at the 35% Review Conference.

#### 5.6.3 Preliminary (60%) Design Analysis

5.6.3.1 General. The Preliminary (60%) Design Analysis shall include all of the requirements of the previous submittals and shall include any revised or updated information.

5.6.3.2 Lighting Calculations. Lighting calculations shall be performed to provide maintained illumination levels in accordance with the Applicable Criteria.

a. Computer generated point-by-point computations shall be provided for all interior spaces, including stairways. Computer models shall be coordinated with the Architect and Interior Designer to ensure surface reflectances and proposed furniture layouts are correctly modeled in the calculations. Workstation partitions, restroom partitions, ceiling height variations and similar features shall be included in the calculations. Computations for each space shall include luminaire types, luminaire light loss factors, luminaire mounting heights, calculation grid plane heights, ceiling heights, surface reflectances, average illuminance, minimum illuminance, maximum illuminance, room name and a graphical representation of the floor plan. Computations for egress paths shall include maximum to minimum illuminance ratios.

b. Computer generated point-by-point computations shall be provided for all site areas requiring illumination, including roadways, parking areas, walkways, athletic areas, exercise areas and security access points. Computer models shall be coordinated with the Site Civil Engineer to ensure surface reflectances (e.g., asphalt, concrete) are correctly modeled in the calculations. Site obstructions such as buildings shall be included in the calculations. Computations for each space shall include luminaire types, luminaire light loss factors, luminaire mounting heights, calculation grid plane heights, surface reflectances, average illuminance, minimum illuminance, maximum illuminance, space name and a graphical representation of the site plan. Computations for walkway egress paths shall include maximum to minimum illuminance ratios.

5.6.3.3 Fire Alarm and Mass Notification Voice Evacuation ADS Layout. Provide a floor plan layout or spreadsheet tabulation identifying all NFPA 72 Acoustically Distinguishable Spaces (ADS), defined as areas intended to have audible occupant notification. Identify which areas require full intelligibility, partial intelligibility, and audibility. The layout or tabulation shall be in addition to and not a substitution for the Interior Fire Alarm and Mass Notification Plan required as part of the Preliminary (60%) Design Drawings.

5.6.3.4 Product Data Sheets. Provide manufacturer data sheets for all project luminaires. Cross reference the data sheets with the luminaire types identified in the Luminaire Schedule. Identify all selected options and accessories on the data sheet by marking the selections on the sheets or by indicating the full catalog number.

5.6.3.5 Cybersecurity Control List. Provide a Cybersecurity Control List for each facility-related control system. Each list shall include all applicable Designer Control Correlation Identifiers (CCIs) as defined in UFC 4-010-06. The control list shall contain all applicable Designer CCIs for the designated C-I-A classification. A unique Specification Section shall be provided for each facility-related control system. Combining control systems in a single Specification Section is not allowed. UFGS Section 25 05 11 shall be used to create the Specification Section for each facility-related control system, edited and

renumbered as appropriate. Each Section shall address all Designer CCIs applicable for the respective control system.

#### 5.6.4 Preliminary (60%) Design Drawings

5.6.4.1 General. All CADD drawings shall be prepared in accordance with Chapter A-10, Drawings.

5.6.4.2 Legend. Provide a legend on a dedicated drawing(s) showing all symbols used throughout the electrical drawings.

5.6.4.3 Site Electrical Drawings. The site electrical drawings shall meet all of the requirements of the concept (35%) submittal, updated to reflect any revised or updated information. Provide dedicated plans for power, communications, lighting and special systems, except plans may be combined into a single electrical site plan for small projects where clarity is not compromised.

a. Site luminaire locations shown on plans shall be based on photometric calculations. Provide a site luminaire schedule with all luminaires used on the site.

b. Site communication single line diagrams shall be provided, except communication single line diagrams may be omitted for project with minor site communication work for which single-line diagrams provide no additional clarity.

5.6.4.4 Electrical Interior Drawings. The interior electrical drawings shall include the designation of all rooms and work areas by name and room number as shown on the architectural drawings. Where applicable, hazardous (NEC Classified) locations shall be shown on the plans and shall be identified by class, division and group as defined in NFPA 70

a. Interior Lighting Plan. Provide dedicated lighting plans showing the locations and types of light fixtures in all spaces, including exit lights.

b. Interior Receptacle Plan. Provide dedicated power receptacle plans showing the locations and types of power receptacles in all spaces.

c. Interior Mechanical Equipment Plan. Provide dedicated mechanical equipment plans showing the locations of mechanical equipment in all spaces, except mechanical equipment and receptacle plans may be combined into a single power plan for small projects where clarity is not compromised.

d. Interior Electrical Equipment Plan. Show electrical equipment on one or more interior electrical plans. Equipment to be shown includes panelboards, motor control centers, switchboards, switchgear equipment, transformers, transfer switches, UPS equipment and other major items of electrical equipment. Indicate the NEC required dedicated electrical space for each piece of equipment.

e. Interior Communications Plan. Provide updated dedicated communication plans showing the locations and types of voice and data outlets in all spaces. Show locations of racks in communication and server rooms.

f. Interior Special Systems Plan. Provide updated dedicated special systems plans showing the locations and types of special systems devices and the location of head-end equipment.

g. Interior Demolition Plan. Provide updated dedicated demolition plans showing all electrical demolition and relocation where applicable. Demolition may be shown on plans with new work where demolition is minor and clarity is not compromised.

h. Interior Fire Alarm and Mass Notification Plan. Provide dedicated fire alarm and mass notification plans showing the locations of control panels, annunciation panels, initiation appliances and notification appliances.

i. Kitchen Equipment Plan. Where applicable, kitchen equipment shall be shown on dedicated plans or may be shown on other electrical plans where clarity is not compromised.

j. Lightning Protection Plan. Provide dedicated lightning protection plans showing the locations of air terminals, down conductors, ground rods and counterpoise.

k. Interior Luminaire Schedule. Provide a luminaire schedule describing the salient features of each luminaire type shown on the plans. Clearly indicate accessories required for each luminaire type, such as dimming drivers (with dimming range), emergency drivers, integral photocells and integral occupancy sensors.

l. Interior Power Single Line Diagram. Provide a power single line diagram showing the overall structure of the power distribution system. The preliminary single line diagram shall include all distribution equipment (e.g., switchboards, panelboards, transformers, generators, and transfer switches). Conductor and conduit sizes and equipment ratings are not required for this submittal.

m. Interior Communication Single Line Diagram. Provide copper, fiber and conduit single line diagrams showing the extension of the Outside Plant to the main telecommunications room and the interconnection between telecommunication rooms within the facility. For facilities with more than one telecommunications room, provide a communication grounding single line diagram.

n. Interior Fire Alarm and Mass Notification (FA/MNS) Single Line Diagram. Provide a FA/MNS single line diagram to include notification and initiation appliances, elevator interconnections, HVAC interconnections, fire suppression interconnections, base-wide MNS interconnections and egress lighting override.

o. Interior Fire Alarm and Mass Notification Input/Output Matrix. Provide an input/output matrix indicating the required sequence of operation of the fire alarm and mass notification system.

### 5.6.5 Preliminary (60%) Design Specifications

The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

## 5.7 PRELIMINARY (OVER THE SHOULDER) SUBMITTAL REQUIREMENTS

### 5.7.1 General.

The purpose of this submittal is to check the design progress and the incorporation of the concept review comments without stopping the design process.

### 5.7.2 Preliminary (Over-the-Shoulder) Design Narrative.

There are no requirements for this submittal.

### 5.7.3 Preliminary (Over-the-Shoulder) Design Analysis.

There are no requirements for this submittal.

### 5.7.4 Preliminary (Over-the-Shoulder) Design Drawings.

The design drawings requirements shall match those listed in the Preliminary (60%) Submittal requirements.

## 5.8 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS

### 5.8.1 Review Comments.

Evaluate the review comments from the previous design submittal reviews and incorporate all approved comments into the design.

### 5.8.2 Final (100%) Design Narrative

The Final (100%) Design Narrative shall include all of the requirements of the Preliminary (60%) Design Narrative. The narrative shall include any revised or updated information, as well as any additional information obtained at the 65% Review Conference.

### 5.8.3 Final (100%) Design Analysis.

5.8.3.1 General. The design analysis shall be accumulative, incorporating all requirements from previous submittals, revised or updated as appropriate. If a Preliminary (60%) Submittal is not required for a particular project, the submittal requirements for a Preliminary (60%) Submittal shall be included with this submittal. Failure to submit a complete Final Design Analysis is sufficient grounds to require a re-submittal of the Final 100% Design package with no extension to the project deadline.

Calculations shall be computed and checked by separate individuals with the checking accomplished by a Registered Electrical Engineer. Calculations and data for the following shall be included in the analysis:

5.8.3.2 Lighting Calculations. Include all of the required information from the Preliminary (60%) Design submittal, updated to reflect any revised or updated information including changes to luminaire types, room configurations, room surface reflectances and furniture layouts. Ensure that no proprietary light fixtures are specified. (Upon request, be able to provide three manufacturer names and catalog numbers for each light fixture).

5.8.3.3 Emergency and Egress Lighting Calculations. Computer generated point-by-point computations shall be provided to demonstrate compliance with NFPA 101 egress and emergency lighting requirements. Calculations shall be provided for all spaces within the means of egress and all spaces requiring emergency lighting. Computations for each space shall include luminaire types, luminaire light loss factors, luminaire mounting heights, calculation grid plane heights, ceiling heights, surface reflectances, average illuminance, minimum illuminance, maximum illuminance, room name and a graphical representation of the floor plan. Computations for egress paths shall include maximum to minimum illuminance ratios.

5.8.3.4 Interior Lighting Power Allowance Calculations. Calculations shall be provided in accordance with ASHRAE 90.1 and other energy codes as referenced in UFC 1-200-02. Compliance with either the Building Area Method or Space-by-Space Method is permitted. Calculations shall follow the steps indicated in ASHRAE 90.1, and shall clearly show that the total interior lighting power is in compliance with ASHRAE 90.1 and other applicable criteria.

5.8.3.5 Site Lighting Power Allowance Calculations. For CFCI site lighting, calculations shall be provided in accordance with ASHRAE 90.1 and other energy codes as referenced in UFC 1-200-02. Calculations shall follow the steps indicated in ASHRAE 90.1, and shall clearly show that the total interior lighting power is in compliance with ASHRAE 90.1 and other applicable criteria.

5.8.3.6 Short Circuit Calculations. Calculations shall be provided to determine the rating of all protective equipment. Assume an infinite bus on the primary unless more accurate data is available. Short circuit calculations shall account for the peak asymmetrical fault current by de-rating any equipment in which the calculated X/R ratio exceeds the equipment's tested X/R ratio. Clearly identify transformer kVA ratings and percent impedance (%Z).

5.8.3.7 Voltage Drop Calculations. Calculations shall be provided for all services and feeders, dry-type transformers, and worst-case branch circuits. Voltage drop calculations shall meet the requirements of ASHRAE 90.1, Chapter 8.

5.8.3.8 Demand Load Calculations. Calculations for each panelboard and switchboard shall be provided. Calculations shall show the demand factors used for each load category (lighting, receptacles, motors, spare, etc.) and shall be in accordance with the NEC. Where connections are made to existing transformers, switchboards or

panelboards, calculations shall be provided demonstrating the adequacy of the existing equipment to serve the additional loads.

5.8.3.9 Feeder Sizing Calculations. Calculations shall be provided demonstrating the rationale for the selection of the feeder size. Applicable NEC correction factors and adjustment factors shall be identified.

5.8.3.10 Generator Sizing Calculations. Calculations shall be provided demonstrating the rationale for the selection of generator sizes. Address starting kVA constraints.

5.8.3.11 Uninterruptible Power Supply (UPS) Sizing Calculations. Calculations shall be provided demonstrating the rationale for the selection of UPS sizes. See UFC 3-520-01 (Stationary Batteries and Battery Chargers) for additional calculation requirements.

5.8.3.12 Protective Device Time-Current Coordination Studies. The electrical system shall be designed such that any fault in the system will be preferentially isolated by the selective operation of only the overcurrent protective device closest to the faulted condition. Where insufficient information is available at the time of design, a performance specification section shall be provided requiring the construction Contractor to perform the protective device time-current coordination studies based on site conditions and selected equipment. The specification shall require the Contractor to submit the analysis for Government approval as a shop drawing submittal..

5.8.3.13 Arc Flash Hazard Analysis. Calculations shall be provided for all electrical equipment. Calculations shall determine the Arc Flash Boundaries and the required PPE levels for all equipment in accordance with NFPA 70E or IEEE Standard 1584. Where insufficient information is available at the time of design, a performance specification section shall be provided requiring the construction Contractor to perform the arc flash hazard analysis based on site conditions and selected equipment. The specification shall require the Contractor to submit the analysis for Government approval as a shop drawing submittal. The construction documents shall direct the Contractor to label the electrical equipment as required by NEC 70E.

5.8.3.14 Photovoltaic (PV) Calculations. Calculations shall be provided to determine the number of photovoltaic modules per string and the number of strings per inverter. Calculations shall take into account the site's lowest recorded low temperature, highest average high temperature, and the corresponding cell temperatures of the photovoltaic modules. Calculations shall demonstrate that the inverter will provide Maximum Power Point Tracking for the full voltage and current ranges expected from the PV array.

5.8.3.15 Cathodic Protection Calculations. Cathodic protection (CP) is a functional requirement for virtually all projects involving new aboveground water tanks, direct buried or submerged structures, or the repair or replacement of similar existing structures. The need for a CP system shall be considered for all projects. A CP system shall be provided where required; see Chapter 3 of UFC 3-570-06. Where provided, the CP system shall comply with UFC 3-570-02A. Provide calculations for the surface area of the protected surface, the current density requirements, the number, size, and type of anodes to be used, the size of all conductors, and the size of the rectifier and branch circuit calculations for the circuit serving the rectifier. Where insufficient information is



available at the time of design, a performance specification section shall be provided requiring the construction Contractor to design the cathodic protection system based on site conditions and selected underground materials. The specification shall require the Contractor to submit the design for Government approval as a shop drawing submittal.

5.8.3.16 LEED Credit and Sustainable Design Documentation. LEED credit and sustainable design documentation shall be provided to demonstrate electrical systems comply with the requirements of LEED credits claimed on the LEED project checklist.

5.8.3.17 Miscellaneous Calculations. See UFC 3-501-01 for additional requirements.

5.8.3.18 Product Data Sheets. Product data sheets shall be provided for all electrical equipment, including luminaires, lighting controls, normal and emergency power distribution equipment, photovoltaic (PV) and other renewable energy equipment, communication and special systems distribution equipment, lightning and surge protection equipment, and grounding equipment..

5.8.3.19 Cybersecurity Control List. Provide an updated Cybersecurity Control List for each facility-related control system reflecting all revised information. Each list shall be tailored for the respective system, indicating which Designer CCI's are not applicable and which are impractical to implement. All applicable CCI's shall be addressed in the respective cybersecurity Specification Section.

#### 5.8.4 Final (100%) Design Drawings

The final (100%) drawings shall be prepared in accordance with Chapter A-10, Drawings. The final (100%) submittal shall include the drawings required for the Preliminary (60%) Submittal, even if a Preliminary (60%) Submittal is not required for the project. The drawings shall be complete and, together with the specifications, shall constitute the Final Construction Documents. In addition to the drawings indicated for the Preliminary (60%) Submittal, the Final (100%) Drawings shall include the following:

5.8.4.1 Site Electrical Plans. Provide dedicated power, lighting, communication and special systems plans, except plans may be combined for small projects where clarity is not compromised.

5.8.4.2 Site Electrical Details. Provide details for all electrical site equipment, including power poles, transformers, switches, manholes, duct lines, conduit stub-ups, equipment foundations, grounding details, luminaires and lighting control devices.

5.8.4.3 Site Electrical Schedules. Provide schedules for site luminaires, site lighting control strategies, site motor feeders and other site electrical equipment as appropriate.

5.8.4.4 Site Electrical Single-Line Diagrams. Provide single-line diagrams for power systems, communication systems and other site electrical systems as appropriate. Separate communication single-line diagrams shall be provided for copper, fiber and conduit, except single-line diagrams may be combined for small projects where clarity is not compromised.

5.8.4.5 Interior Electrical Plans. Provide plans showing locations of all electrical equipment and devices. Feeders and circuits shall be indicated on plans or by schedules. Devices shall include lighting control devices (e.g., sensors, switches) and fire alarm/mass notification initiation and notification appliances. Communication plans shall include but not be limited to devices, conduits, cable trays, cabinets, racks and PDS. Mechanical equipment plans shall show locations of all electrically driven equipment, and shall include electrical characteristics (e.g., HP, kW, kVA). Dedicated plans shall be developed for lighting protection system and the photovoltaic (PV) systems. Lightning protection plans shall include but not be limited to counterpoise, air terminals, roof conductors, ground connections and conductor sizes. Photovoltaic plans shall include but not be limited to photovoltaic modules, inverters, disconnect switches, combiner boxes, meters, and monitoring equipment.

5.8.4.5 Electrical Interior Details. Provide details for all electrical interior equipment, including luminaires, power distribution equipment, building communication equipment, fire alarm and mass notification equipment, special systems equipment, grounding equipment, lightning protection equipment, and other equipment for which a detail will clarify or convey the equipment requirements. Provide wiring diagrams for lighting and receptacle controls. Provide a luminaire detail for each luminaire type, depicting the physical appearance of the luminaire and listing all salient features.

5.8.4.6 Electrical Interior Single-Line Diagrams. Provide single-line diagrams for power systems, communication systems, fire alarm and mass notification systems, access control systems, intrusion detection systems, public address systems and other electrical systems as appropriate. Single-line diagrams shall show the location of the various components and interconnections with other systems.

5.8.4.7 Electrical Interior Schedules. Provide schedules for wire and conduit, panelboards, transformers, luminaires, lighting control strategies, special power outlets, and other electrical equipment as appropriate. Panel schedules shall include panel rating, AIC rating, phase loads, and room numbers for loads.

5.8.4.8 Electrical Interior Lighting Control Documentation. Each unique lighting control scenario shall be represented by a unique lighting control strategy identified on the plans for each room or space. Lighting control strategies shall not be identified by group (e.g., offices). Lighting control strategies shall be clearly conveyed in a tabulated narrative format and shall include a description of operation and specify a list of lighting equipment and devices required to implement the strategy. Strategies shall be labeled and cross-referenced to the applicable rooms on the lighting plans, and shall be supplemented with wiring, functional, or schematic diagrams as appropriate for clarity. As a minimum, provide a typical wiring diagram for each lighting controller (e.g., room controller, lighting control panel, etc.). For projects with programmable control panels, provide lighting control panel relay schedules and channel schedules as appropriate. Show all lighting control system components on the plans.

a. Line voltage dimming shall not be used.

b. Wireless lighting controls shall not be used without written permission from both the Installation and Savannah District Electrical Section (CESAS-EN-DE).

5.8.4.9 Fire Alarm and Mass Notification Input/Output Matrix. Provide an input/output matrix indicating the required sequence of operation of the fire alarm and mass notification system.

5.8.4.10 Enlarged Electrical Plans. Provide enlarged electrical plans for congested areas where interference between various electrical systems, cable trays, piping, ducts, etc., is likely. At a minimum include enlarged plan views of the communications and electrical rooms.

#### 5.8.5 Final (100%) Design Specifications

The final (100%) specifications shall be prepared in accordance with Chapter A-10, Specifications, using the Unified Federal Guide Specifications (UFGS). Referenced codes and standards shall be checked to assure the referenced date matches the most current date. Specifications shall be fully edited, choices shall be selected, blank spaces shall be filled, and inapplicable text shall be deleted. All electrical equipment shall be specified. For equipment for which there is no UFGS specification available, provide a specification in UFGS format.

#### 5.8.6 Final (100%) Design Certifications

For projects with Arms Rooms, provide a completed Arms Room Checklist as described in Chapter A-3, Architecture.

### **5.9 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**

In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

### **5.10 REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP'S.**

#### 5.10.1 General

Unless indicated otherwise, the Request for Proposal (RFP) shall comply with the requirements of UFC 1-300-07A. The RFP shall contain adequate information for the design-build contractor to develop a bid package. Information shall include the primary source of power, characteristics of the power supply to the site, and the communications point of connection and requirements. Required demolition work, available power, the source, location, and adequacy of the primary supply should be included. Indicate total connected load and resulting KVA demand load by applying demand (state operating assumptions) and diversity factors based on square footage. Unless indicated otherwise, the A-E shall be furnished an electronic format sample or template for the written technical requirements portion of the RFP to be edited for the specific project.

### 5.10.2 Project Requirements

The RFP shall identify all known, and any potential, systems and constraints that apply to the project. Systems might include fire alarm, mass notification, IDS, CCTV, Secure areas, SIPRNET, data, telephone, emergency generator, UPS, etc. Constraints might include points of connection for existing systems (e.g. – fiber-optic, telephone, primary electrical); use of overhead or underground distribution; customer-defined requirements or constraints for specific installations; target lighting levels; renovation issues (e.g. adequacy of existing interior electrical distribution system and communications service; potential NEC hazardous/classified areas).

### 5.10.3 Coordination

Coordinate the functional requirements of the facility with the User Representatives, Privatized Utility Representatives (where applicable), and Installation Agencies. Identify all privatized utilities on the Installation and clarify the responsibilities of both the Contractor and the privatized utilities. Privatized Utilities may include primary power, site lighting and CATV. Installation Agencies may include the Installation Fire Department, the Installation Physical Security Office, and the Network Enterprise Center (NEC). Identify utility connection points and confirm adequacy of existing electric utilities. Where inadequate, provide instructions for upgrading the system. The RFP shall include documentation demonstrating coordination.

### 5.10.4 Draft RFP Submittal Requirements

5.10.4.1 Design Narrative. Provide a design narrative describing the electrical systems and all functional and technical electrical requirements for the site and buildings. Include any appendices provided by the privatized utilities or government agencies.

5.10.4.2 Design Criteria. Provide a comprehensive list of applicable criteria for all electrical systems included in the scope of work.

5.10.4.3 USGS Specifications. Unless instructed otherwise, the RFP shall require the use of Unified Facilities Guide Specifications (UFGS), and shall require a marked-up version of specifications be provided to clearly identify revisions.

5.10.4.4 Miscellaneous Criteria. Include any appendices or specifications provided by the privatized utilities or government agencies in the RFP.

5.10.4.5 Electrical Site Plan. Provide an electrical site plan show the routing of existing power and communication utilities and the locations of existing electrical equipment. Clearly indicate the point of connection to each utility.

### 5.10.5 Final RFP Submittal Requirements

5.10.5.1 Review Comments. Evaluate the review comments from the previous design submittal reviews and incorporate all approved comments into the RFP.

5.10.5.2 Consistency. Verify consistency between the drawings, appendices, and RFP text.

\*\*\* End of Section \*\*\*

**CHAPTER A-6  
FIRE PROTECTION**

**Revised July 2020**

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## CHAPTER A-6

### FIRE PROTECTION

#### 6.1 GENERAL.

6.1.1 Scope. This chapter provides general guidance for the preparation and development of the Fire Prevention/Life Safety design.

6.1.2 Purpose. The purpose of Fire Protection design is to establish optimum safeguards against loss of life and property by fire that are consistent with the mission, the risk involved, and economic utilization. Fire Protection design shall be coordinated with the Architectural, Structural, Environmental, Electrical, and Mechanical sections. At a minimum, the design shall conform to the applicable standards contained in the current National Fire Code - published by the National Fire Protection Association (NFPA) - and other criteria referenced in paragraph 6.2, "APPLICABLE PUBLICATIONS". In case of conflict between NFPA codes and other criteria referenced hereinafter, UFC 3-600-01 shall govern. The NFPA codes are not the final criteria for Fire Protection design unless the other referenced criteria so state, or those criteria do not address an issue. Unless otherwise noted, the designer shall use the most current version of the publications listed or referenced in this chapter as of the date of contract award.

6.1.3 Qualifications of Fire Prevention Engineer. The design of Fire Protection features shall be performed by, or under the direct supervision of, a Qualified Fire Protection Engineer (QFPE). The QFPE shall be an individual who is a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES) and has relevant fire protection engineering experience. Prior to issuance of the Notice to Proceed, the QFPE must submit a written copy of their resume indicating education, professional registration and work experience to the Designated Fire Protection Engineer (DFPE)\*. The Qualified Fire Protection Engineer shall submit a letter certifying that the design complies with applicable Unified Facilities Criteria and other referenced codes and criteria as applicable to the project under design. The letter must include an imprint of their professional engineering stamp with signature.

The requirement for a QFPE is applicable to engineering services for design-bid-build projects, as well as all phases of design-build projects including RFP development, design development, and construction.

\*Refer to UFC 3-600-01 for the definition of "Designated Fire Protection Engineer (DFPE)."

6.1.4 Required Design. Unless specifically directed otherwise by the Savannah District's Designated Fire Protection Engineer (DFPE), a fire protection design analysis and life safety plan(s) is required and shall be included in every project. Sufficient copies of the design submittals shall be provided for submission to Architectural, Structural, Environmental, Electrical, and Mechanical Sections for review.

6.1.4.1 Design Analysis. Where applicable, discuss the following minimum fire protection provisions (include required vs. provided):

- a. Identification of all fire protection and life safety related codes and standards applicable to the project, including the edition. This includes Host Nation requirements.
- b. Building code analysis (e.g., type of construction, height and area limitations, building separation, exposure protection, etc.).
- c. Classification of occupancy (per both IBC and NFPA 101).
- d. Requirements for fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions, compartmentation and special hazard protection (both horizontal and vertical). Include the associated fire resistance rating.
- e. Requirements for protection of horizontal and vertical penetrations and openings as well as the associated fire resistance rating.
- f. Separation from hazards per NFPA 101.
- g. Interior finish ratings
- h. Means of egress provisions and components (occupant load, exit capacity, exit width, travel distance, common path of travel, dead-end corridors, use of suites, etc.).
- i. Water supplies, water distribution, location of fire hydrants, *Fire Flow* calculations.
- j. Location of fire department connections (FDCs).
- k. Location of post indicator valves (PIVs) and other control or isolation valves.
- l. Analysis of automatic sprinkler and suppression systems and protected areas. Include supporting calculations used to establish system performance requirements such as hydraulic analysis of water demand or agent concentration and quantity.
- m. Standpipe systems
- n. Location of fire extinguisher cabinets and brackets (where required)
- o. Fire detection (the type of detection and type/location of detectors).
- p. Fire alarm system (the type of alarm system, location of the fire alarm equipment and mass notification).
- q. Smoke management or control methods.
  - r. Connection to and description of base *Fire Alarm Reporting System*.
  - s. Coordination with security and antiterrorism requirements, including connection to *Installation-wide Mass Notification System*.
  - t. Fire department access.



- u. AHJ approved equivalencies (see paragraph entitled “Equivalencies” in Chapter 1 of UFC 3-600-01).
- v. For projects not within the United States or its territories, identify code/criteria conflicts and AHJ approved design solutions or equivalencies to DoD or Host Nation criteria necessary to resolve. The analysis must also identify the associated impact on project cost.
- w. Initial, or draft, integrated performance verification and testing plan(s) where multiple systems across multiple trades rely on an integrated operation to perform the desired result.

#### 6.1.4.2 Fire Prevention/Life Safety Drawing(s).

6.1.4.2.1 A separate Fire Prevention/Life Safety floor plan drawing(s) shall be submitted for all projects that are:

- a. Places of assembly, or
- b. Educational or institutional type facilities, or
- c. Commissaries or any other buildings exceeding 930 square meters (10,000 square feet) in gross area, or
- d. Three stories or greater above grade, or
- e. As required by the Specific Instructions.

6.1.4.2.2 Fire Prevention/Life Safety drawings are to be labeled as, “For reference use only.” A statement is to be made on the drawing explaining that it is not part of the construction contract, and that all information contained on it is called for elsewhere. Acceptable drawings shall show at least the following items of interest to Fire Protection/Life Safety personnel. Where applicable, the following minimum fire protection provisions must be included on the life safety plans:

- a. All minimum fire protection provisions listed in paragraph 6.1.4.1, on a separate code summary sheet.
- b. Capacity and number of occupants using each major means of egress component (e.g., stairs, stair doors, exterior doors, assembly exit doors).
- c. Maximum travel distance, dead-end corridor, common path of travel, accessible means of egress and exit components for each floor and occupancy classification. When suites are used, indicate type, location, area and arrangement.
- d. IBC and NFPA occupancy classification of each room, area or compartment (on the drawings or in tabular form). Include occupant load of each room, area or compartment. Similar occupancies can be grouped together for occupant load calculations.
- e. Location and rating of all fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions (both horizontal and vertical). Barriers requiring fire resistance rated

supporting construction must be specifically identified for coordination with the structural design.

- f. Location of hazardous materials storage, handling and use that exceed the maximum allowable quantities.
- g. Structural fireproofing locations and associated ratings.
- h. Description of any special fire protection features.

6.1.4.3 Fire Prevention Engineer's Credentials. A copy of the QFPE's credentials and the approval provided by the Savannah District's DFPE shall be a part of each required fire protection submittal.

6.1.5 Critical Projects. Projects identified as "Critical Projects" shall have a complete, fully detailed design of all Fire Protection, Detection, and/or Life Safety Systems. Critical Projects include the following facilities:

- a. Medical facilities
- b. Aircraft maintenance and storage facilities
- c. Engine test cells/areas
- d. Missile assembly facilities/areas
- e. Ordinance facilities or exposed explosives areas
- f. Facilities which include significant data processing/telecommunications systems, as defined by UFC 3-600-01
- g. POL facilities
- h. Flight simulators/Computer based training facilities.
- i. Warehouses with high piled or high rack storage
- j. JSOC/SOTF facilities
- k. Mission-essential facilities
- l. Any facility occupied (during normal working or sleeping times) by 100 or more persons

## 6.2 APPLICABLE PUBLICATIONS

Designs shall be created using the most current version of Unified Facilities Criteria (UFCs), which are available on the [Whole Building Design Guide](#) website. UFCs are effective upon issuance and shall be applied as prescribed in paragraph 1-3.1 of UFC 1-200-01. The versions of the IBC and IEBC to be used are specified in paragraph 1-6 of UFC 1-200-01.

UFC 1-200-01	DoD Building Code
UFC 3-230-01	Water Storage, Distribution, and Transmission
UFC 3-600-01	Fire Protection Engineering for Facilities
UFC 4-010-01	DoD Minimum Antiterrorism Standards for Buildings
UFC 4-021-01	Design and O&M: Mass Notification Systems
NFPA	National Fire Codes (as modified by UFC 3-600-01)
International Code Council	International Building Code - IBC (as modified by Chapter 2 of UFC 1-200-01)
International Code Council	International Existing Building Code - IEBC (as modified by Chapter 3 of UFC 1-200-01)
FM Global	Property Loss Prevention Data Sheets ( <a href="http://www.fmglobal.com/">http://www.fmglobal.com/</a> )

### 6.3 PRECONCEPT SUBMITTAL REQUIREMENTS

No requirements for this section.

### 6.4 CODE 3 DESIGN REQUIREMENTS

No requirements for this section.

6.4.1 Submittals. Submittal content and format shall be as described in UFC 3-710-01A, "Technical Instructions for Code 3 Design with Parametric Estimating".

### 6.5 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS

6.5.1 Concept Design Analysis. A consolidated submittal is required to include features of paragraph 6.1.4.1, "Design Analysis". Submittals shall comply with the requirements of this chapter as well as chapters A-2, "STRUCTURAL"; A-3, "ARCHITECTURAL"; A-4, "MECHANICAL"; A-5, "ELECTRICAL"; A-7, "ENERGY ANALYSIS" (if necessary); and A-8, "ENVIRONMENTAL".

6.5.2 Concept Fire Prevention/Life Safety Drawing(s). This drawing (if required) shall contain all the project features required in paragraph 6.1.4.2, "Fire Prevention/Life Safety Drawing(s)", for review. The drawing need not be in final form for this submittal; however, changes in content shall not be made except by the direction of Savannah District technical personnel through the Project Manager.

6.5.3 Concept Fire Prevention Engineer Certification. This submittal shall include written certification by the A-E's Fire Prevention Engineer that the design of the project meets all appropriate listed criteria.

## **6.6 PRELIMINARY DESIGN SUBMITTAL REQUIREMENTS (FORMAL 60% SUBMITTAL)**

6.6.1 Preliminary (60%) Design Analysis. This shall be an updated version of the Concept Design Analysis incorporating review comments and design changes.

6.6.2 Preliminary (60%) Fire Prevention/Life Safety Drawing(s). This shall be an updated version of the Concept Fire Prevention/Life safety Drawing(s) incorporating review comments and design changes.

6.6.3 Preliminary (60%) Fire Prevention Engineer Certification. This submittal shall include written certification by the A-E's Fire Prevention Engineer that the design of the project meets all appropriate listed criteria.

6.6.4 Specifications. The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

## **6.7 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS**

6.7.1 Final Design Analysis. The final Fire Protection design analysis shall be developed from the design analysis submitted with the concept submittal. It shall be an updated version, not an amendment to earlier work. It shall incorporate all Fire Protection requirements, calculations, analyses, determinations, etc. required by all technical sections and chapters of this handbook and shall accurately reflect the final project design. The submittal shall be logically separated into subsections relating to the various technical disciplines involved.

6.7.2 Final Fire Prevention/Life Safety Drawing(s). The final drawing(s) shall be complete and shall accurately reflect the final design features.

6.7.3 Final Fire Prevention Engineer Certification. The A-E's Qualified Fire Protection Engineer shall certify the final design in written form. This is a separate certification from that required at the Concept submittal. The *QFPE* must review the complete 100 percent design drawings and specification submission (all disciplines) and document in writing that the design is in compliance with UFC 3-600-01 and all applicable fire protection and life safety design criteria. The review must provide verification that all items listed in the design analysis are correctly shown on the drawings and in the specification and list any approved equivalencies or deviations from UFC 3-600-01. This design compliance document must be submitted with the final design submission as part of the design analysis and must bear the signature and professional seal of the *QFPE*.

#### 6.7.4 Final Specifications.

6.7.4.1 Typed project specifications with electronic copy shall be submitted in accordance with chapter A-11, "SPECIFICATIONS".

6.7.4.2 Specifications will not be restrictive. Generally, the description will be such that at least three manufacturers can meet the specified requirements. Do not use trade names in the specifications. Shall include the requirement to provide shop drawing submittals to DFPE for record keeping purposes.

6.7.4.3 Specifications for fire suppression systems shall be UFGS adapted for the project. Components such as smoke detectors, heat actuated devices, and control panels for clean-agent systems shall be specified in the Fire Suppression specifications.

6.7.4.4 The subparagraphs on "Electrical Work" shall be carefully coordinated with the electrical section of the specifications. There shall be no conflicts as to which section covers starters, controls, or wiring, and no conflicts as to the type of starters required for the individual items of equipment.

### 6.8 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS

6.8.1 Notice. In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

6.8.2 Compliance. Comments affecting Fire Protection that are generated during the Final Design review shall be incorporated into the design analysis and drawing(s) in the Corrected Final submittal. Recertification by the Fire Prevention Engineer shall be required.

### 6.9 REQUIREMENTS FOR DESIGN/BUILD RFP PACKAGES

To be provided with specific instructions for the contract or delivery order.

\*\*\* End of Section \*\*\*

**ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, UMCS**

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## CHAPTER A-7

### ENERGY ANALYSES, ECONOMIC ANALYSES, CONTROL SYSTEMS, EMCS

#### 7.1 GENERAL

As stated by Public Law 100-615, it is United States policy that the Federal Government has the opportunity and responsibility to develop, demonstrate, and promote energy conservation, solar heating, solar cooling, and renewable energy sources in Federal buildings.

7.1.1 Analyses. Terminology, acronyms, abbreviations, and symbology shall be defined. All calculations, data, methods, and conclusions documented. Technical analyses shall be performed using approved methods.

7.1.2 Site Adaptations. Requirements given in this chapter apply equally to new designs, major renovations, and adaptations of previous designs. Designers may have to modify previous designs in order to bring the design into accord with current criteria. All pertinent analyses must be submitted for adaptations of previous designs unless specifically exempted by the Government. Previous design analyses for solar applications, conservation methods, life cycle cost analysis (LCCA), and energy system simulations may be submitted, in lieu of a new analysis, for cases where the following conditions are fully satisfied.

- a. The Designer reviews and verifies the previous analysis.
- b. Climate, siting, and orientation must be equivalent.
- c. Design factors impacting analyses must be equivalent.
- d. Alternatives being studied must be equivalent.
- e. Previous analysis methods meet current requirements.

7.1.3 Changes During Design. All significant changes and their impacts shall require that applicable analyses (EB, LCCA) be revised and resubmitted, regardless of when or how the change occurs during the project. Changes may also necessitate revised economic and engineering analyses.

#### 7.2 APPLICABLE PUBLICATIONS

This list is a minimum requirement, and is not intended to be an all inclusive requirement. The most current editions of the publications listed below, as of the date of contract award, shall be used, unless directed otherwise.

##### 7.2.1 Unified Facilities Criteria (UFC).

UFC 1-200-02	High Performance and Sustainable Building Requirements
UFC 3-101-01	Architecture
UFC 3-400-02	Design: Engineering Weather Data



UFC 3-410-01	Heating, Ventilating, and Air Conditioning Systems
UFC 3-410-02	Direct Digital Control for HVAC and Other Building Systems
UFC 3-420-01	Plumbing Systems
UFC 3-440-01	Facility-Scale Renewable Energy Systems
UFC 3-470-01	Utility Monitoring and Control System (UMCS) Front End and Integration
UFC 4-010-06	Cybersecurity of Facility-Related Control Systems

#### 7.2.2 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), Inc. Standards.

ASHRAE Standard 90.1	Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE Standard 90.2	Energy-Efficient Design of Low-Rise Residential Buildings
ASHRAE Standard 189.1	Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
ASHRAE Standard 202	Commissioning Process for Buildings and Systems
ASHRAE Guideline 0	The Commissioning Process

#### 7.2.3 Guide Specifications.

See Chapter 11 of this manual.

#### 7.2.4 Engineering Regulations (ER).

ER 1110-1-8173	Energy Modeling and Life Cycle Cost Analysis
ER 1110-345-723	Total Building Commissioning Procedures

#### 7.2.5 Army Regulations (AR).

AR 11-18	The Cost and Economic Analysis Program
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#### 7.2.6 Code of Federal Regulations (CFR).

10 CFR Part 436	Federal Energy Management and Planning Programs
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### 7.2.7 Life-Cycle Cost Analysis (LCCA) Criteria.

NIST Handbook 135 Life-Cycle Cost Estimating Manual for the Federal Energy Management Program

OMB Circular      Guidelines and Discount Rates for Benefit-Cost Analysis of  
Number A-94      Federal Programs

### 7.2.8 Energy Criteria.

EPAct 2005              Energy Policy Act of 2005 (Public Law 109-58)

EISA 2007              Energy Independence and Security Act of 2007

## 7.3 PRECONCEPT SUBMITTAL REQUIREMENTS

Pre-concept submittal of the following items is only required when called for in the specific instructions to the contract for delivery order.

7.3.1 HVAC Alternatives Coordination. Before commencing analysis of HVAC systems, contact CESAS-EN-DM for approval of selected alternatives. Submit written confirmation of approvals documenting alternatives considered, persons contacted, basis of alternatives chosen, alternatives approved, and date.

7.3.1.1 Electric Resistance Heating shall comply with the requirements of UFC 3-410-01.

7.3.2 Modeling Input Data. Before commencing computer modeling runs, submit the following items to CESAS-EN-DM for review.

- a. All modeling input data.
- b. Single-line rough layout sketches (Not to Scale) for each alternative in sufficient detail to show zoning, approximate distribution lengths, and quantities for major components.

## 7.4 CODE 3 DESIGN SUBMITTAL REQUIREMENTS

Any Base of project specific requirements will be provided with specific instructions to contract or delivery order.

## 7.5 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS

The following items shall be submitted for review. See paragraph 7.10, TECHNICAL REQUIREMENTS, for instructions on methods and content.

- a. Printouts of input/output data for Life-Cycle Cost Analysis (all alternatives)
- b. Printouts of input/output data for Energy Analysis (all alternatives)
- c. U-value calculations for exterior surfaces
- d. Energy conservation methods documentation

- e. Outline specifications

## **7.6 PRELIMINARY (OVER THE SHOULDER) SUBMITTAL REQUIREMENTS**

If project specific instructions require this section, rather than section 7.7, the requirements identified in section 7.7 shall be met for this section, otherwise, there are no requirements for this section.

## **7.7 PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS**

The Preliminary Design Submittal will be a refinement of the Concept Design. All comments from this office relating to Concept Design shall be incorporated in the Preliminary Design. The following items shall be submitted for review. See paragraph 7.10, TECHNICAL REQUIREMENTS, for instructions on methods and content.

- a. The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

## **7.8 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS**

The Final Design Submittal will be a refinement and completion of the Concept Design and/or the Preliminary Design. All comments from this office relating to Concept Design and Preliminary Design shall be incorporated in the Final Design. The following items shall be submitted for review. See paragraph 7.10, TECHNICAL REQUIREMENTS, for instructions on methods and content.

- a. HVAC controls drawings (shown on MI plates)
- b. Printouts of input/output data for Finalized Energy Analysis, that reflect actual design conditions (all alternatives)
- c. ASHRAE 90.1 compliance forms
- d. ASHRAE 189.1 compliance forms, as applicable per UFC 1-200-02
- e. EPAAct 2005 compliance documentation
- f. Energy & Sustainability Record Card, per Chapter A-14 of this Design Manual
- g. Typed, fully edited project specifications
- h. Archived, executable modeling software files for the Finalized Energy Analysis for the proposed and baseline design, including all pertinent files. (e.g. – Trane Trace .taf file, including weather and day lighting files) (Submitted for Record Keeping Purposes)

## **7.9 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS**

In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments. The following items shall be submitted for record keeping purposes:

- a. Archived, executable modeling software files for the Corrected Finalized Energy Analysis for the proposed and baseline design, including all pertinent files. (e.g. – Trane Trace .taf file, including weather and day lighting files)

## 7.10 REQUIREMENTS FOR DESIGN/BUILD RFP PACKAGES

To be furnished with specific instructions relevant to the contract or delivery order.

## 7.11 TECHNICAL REQUIREMENTS

This section prescribes detailed procedures, acceptable methods and minimum content requirements for studies, analyses, and designs. Unless otherwise specified, all applicable studies shall be required for all new building design projects, major additions to existing buildings, and major renovations of existing buildings or energy systems.

7.11.1 Modeling Software. The following computer software is approved for use as indicated below and allowed in Chapter A-7. Some computer packages offer various alternative solution methodologies. The designer must select appropriate options which meet the requirements given in Chapter A-7. Any computer programs other than the ones listed below must be approved by CESAS-EN-DM.

<u>Computer Software Option</u>	<u>Most Detailed Simulation</u>
DOE 2	hourly calculations for 365 days
EnergyPlus	hourly calculations for 365 days
eQuest	hourly calculations for 365 days
Trane TRACE 700	hourly calculations for 365 days
Carrier HAP	hourly calculations for 365 days

7.11.2 Life Cycle Cost Analyses. Unless otherwise authorized, constant dollar methods given in NIST Handbook 135 shall be used. Analyses shall be based on actual expected operating conditions, energy usage, and costs. Selections of major systems and equipment must be supported by economic analyses except in the situations listed below. Major systems include all HVAC systems unless stated otherwise. If documentation that no utilities are available at or near project site is provided by designer of record the life cycle cost analysis for determining the heat fuel source is not required.

- a. There are no reasonable alternatives for comparison
- b. A waiver has been approved exempting the requirement
- c. The cost of the analysis is greater than any potential benefit

7.11.2.1 Cost Estimates. All economic analyses must include cost estimates.

### 7.11.2.2 Computer Analyses

- a. Provide complete input and output of the economic program. The analysis shall use constant dollar methods as given in NIST Handbook 135. Computerized economic analyses shall be made using the Building Life Cycle Cost (BLCC) program. The BLCC program is available from the Federal Energy Management Program web site at: <https://www.energy.gov/eere/femp/building-life-cycle-cost-programs>. Before using any computer program, make sure that it is updated with the most current discount factors published in the periodic supplement to NIST Handbook 135.
  - b. The calculations should be based on the expected hours of operation, energy usage and costs, and should include process/miscellaneous loads. Contact the installation for current utility rates.
  - c. Provide a narrative describing HVAC system alternatives, zoning, and fuel sources. The LCCA should consider three alternatives. If there are only two viable alternatives provide narrative discussions on those systems that were considered but were deemed not viable.
  - d. Economic analyses must include cost estimates. Lump sum estimates are not acceptable. Provide sources for all costs (construction, maintenance, etc.) used, all backup information, and any assumptions made.

7.11.2.3 Site Energy Costs. When purchased energy is used, analyses shall be based on site energy usage and the actual cost of energy at the site. Purchased energy is energy for which the site is billed at a rate which includes all applicable costs (e.g. fuel costs, operating costs, generating losses, distribution losses, profit, taxes).

7.11.2.4 Source Energy Costs. When generated energy is used, analyses should be based on the system's source fuel input, fuel costs, and efficiencies. Generated energy is energy for which the Government operates or controls the generation and distribution system.

7.11.2.5 Rules. The overriding factor in selections shall be the mission function of the Customer. Alternatives must meet the functional requirements. Selections between alternatives shall be for systems with the lowest total LCC.

7.11.3 U-Values. Exterior surfaces of thermally controlled spaces shall be in accordance with the following criteria:

UFC 1-200-02      High Performance and Sustainable Building Requirements

UFC 3-101-01      Architecture

Submit U-value calculations for exterior surfaces of conditioned buildings to include typical walls, floor, roof, and gross (weighted average) walls.

7.11.4 Energy Conservation. The design shall be in compliance with UFC 1-200-02, High Performance and Sustainable Building Requirements, which in turn requires compliance

with ASHRAE 90.1 and portions of ASHRAE 189.1. ASHRAE 90.1 and 189.1 have several methods of complying with the standard. The path selected to show compliance shall be clearly documented (narrative, forms, calculations). UFC 1-200-02 can be accessed at the following website: <https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc>

7.11.5 On-Site Renewable Energy. Designs shall comply with UFC 1-200-02, High Performance and Sustainable Building Requirements.

7.11.6 Energy Systems. Three energy efficient solutions shall be developed for each individual energy system in accordance with the following criteria:

UFC 1-200-02 High Performance and Sustainable Building Requirements

UFC 3-410-01 Heating, Ventilating, and Air Conditioning Systems

7.11.6.1 HVAC System Analysis. Any facility that is heated and/or cooled or heated only will be analyzed with a computer program that uses established weather data files and performs 8,760 hourly calculations. Computer programs are listed in Section 7.11.1. Energy calculations for buildings that do not require a computer simulation may use a computer program or appropriate methods explained in the most current edition of the ASHRAE Fundamentals Handbook. Provide the complete input (room, systems, room assignment, plants, plant assignments, custom members, custom schedules) and output of the program for all alternatives.

- a. Weather data files shall be typical meteorological year (TMY, TMY2, and TMY3), taken from the Department of Energy's website ([www.doe2.com](http://www.doe2.com)) or the National Renewable Energy Laboratory's website ([http://rredc.nrel.gov/solar/old\\_data/nsrdb/1991-2005/tmy3/](http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/))
- b. Operating and Occupancy Schedules: Use ASHRAE standard schedules for the energy calculations. If the building type being analyzed does not correspond to an ASHRAE standard schedule, the designer of record shall create schedules that match the expected occupancy and operating schedules of the building as closely as possible.

7.11.7 Renovations. Refer to UFC 1-200-02 for requirements for all Renovations.

7.11.8 Energy Conservation Investment Program (ECIP). This paragraph's instructions only apply to projects designated as ECIP funded. Validations and revalidations shall be done as specified in the Energy Conservation Investment Program (ECIP) guidance. If revalidation shows a project or a portion of a project does not meet current ECIP criteria, then designers must provide a full explanation of the reasons including discussion of significant differences between the original validation and the revalidation. All other pertinent requirements given in this chapter apply to ECIP projects, unless stated otherwise by specific instructions.

7.11.9 Energy Engineering Analysis Program (EEAP). Scope of work requirements for EEAP studies are provided on a case by case basis. No other requirements given in this chapter apply to EEAP studies unless specifically so stated in the EEAP Scope of Work.

7.11.10 HVAC Controls. HVAC control systems designs shall be in accordance with the guidance presented in UFC 3-410-02. Designs for HVAC control systems shall be for Direct Digital Control (DDC) systems.

7.11.10.1 Drawings. Refer to UFC 3-410-02 for HVAC control drawings requirements. HVAC control drawings (MI plates) shall be provided as required for a complete design, per UFC 3-410-02 requirements.

7.11.10.2 Specifications. Unified Facilities Guide Specifications (UFGS) can be found online at <https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs>.

7.11.10.3 Control Panel Locations. Clear wall and floor space shall be reserved for each HVAC control panel. Verify clearances required for adequate maintenance access are satisfied.

7.11.11 Utility Monitoring and Control System (UMCS) Integration. Coordinate with each Installation for specific requirements for integrating the Building DDC system into the Installation Utility Monitoring & Control System (UMCS).

## 7.12 GLOSSARY OF TERMS AND ABBREVIATIONS

AABC	Associated Air Balance Council
AC	Air Conditioning (or cooling)
AFF	Above Finished Floor
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
BLAST	Building Loads Analysis and System Thermodynamics
Btu	British Thermal Unit
C	Celsius
CDD	Cooling Degree Days
CERL	Construction Engineering Research Laboratory
cf	cubic feet
CFR	Code of Federal Regulations
CWE	Current Working Estimate
DDC	Direct Digital Control
DoD	Department of Defense
DoE	Department of Energy
DOS	Disk Operating System (e.g. IBM or Microsoft)
EB	Energy Budget
EMCS	Energy Monitoring and Control System
ETL	Engineering Technical Letter
F	Fahrenheit
FCL	Future Cabinet Location (EMCS)
FID	Field Interface Device
g	gram
h	hour
HDD	Heating Degree Days
hp	horsepower
HVAC	Heating, Ventilating, and Air Conditioning



I/O	Input/Output
J	Joule
k	kilo = 1,000
LCC	Life Cycle Cost
LCCID	Life Cycle Cost In Design (by CERL)
m	meter
M	Mega = 1,000,000
MILCON	Military Construction
Mux	Multiplexer
NBS	National Bureau of Standards
NCEL	Naval Construction Engineering Laboratory
NEBB	National Environment Balancing Bureau
NEC	National Electrical Code
NTIS	National Technical Information Service
SIR	Savings to Investment Ratio
SPW	Single Present Worth
TABB	Testing, Adjusting and Balancing Bureau
UFGS	Unified Facilities Guide Specifications
UMCS	Utility Monitoring and Control System
UPW	Uniform Present Worth
UPW*	Modified UPW

\*\*\* End of Section \*\*\*

**CHAPTER A-8**  
**SITE ENVIRONMENTAL**

**Revised July 2020**

Chapter A-1 has been modified to include all the requirements of this chapter. Refer to chapter A-1, 'SITE DEVELOPEMT, INCLUDING WATER AND SEWER' for site environmental information and submittal requirements.

\*\*\* End of Section \*\*\*

**COST ESTIMATING**

**1.0 PURPOSE**

1.1 This chapter provides specific guidance for the preparation of cost estimates for Military, Civil and HTRW construction projects. Construction cost estimates serve several purposes, to include establishing program/project funding, controlling costs during design, evaluating bids, negotiating contracts and modifications, and used as a guide for the review and approval of contractor proposed "schedule of values" for payment purposes during construction. As such, they must be consistent with the best estimating practices in the construction industry, as well as being current, complete, and accurate. Cost estimates must be prepared to reflect the expected cost to the Government to perform the work by contract and include all reasonable cost which a prudent experienced and well equipped contractor might anticipate in his/her bid.

**2.0 REFERENCE PUBLICATIONS**

- 2.1 MII Documentation, Latest Version
- 2.2 ER 111 0-1-1300, Cost Engineering Policy and General Requirements
- 2.3 ER 1110-3-1300, Military Programs Cost Engineering
- 2.4 ER 1110-2-1302, Civil Works Cost Engineering
- 2.5 ER 1110-3-1301, Cost Engineering Policy and General Requirements for HTRW Remedial Action Cost Estimates
- 2.6 UFC 3-740-05 Construction Cost Estimates
- 2.7 EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule-Region III

**3.0 DEFINITIONS:**

3.1 Program Amount (PA) Total escalated amount of project funds authorized by Congress, or the customer, to be charged to construction (excludes title II engineering and related project design cost). The PA includes the estimated construction contract cost and allowances for construction contingencies, supervision and administration, preparation of as-built drawings, engineering and design services during construction, commissioning and all other cost authorized by the directive or instructions to be charged to construction. Some typical "other" cost may include private utilities costs and costs that might be incurred by the Installation or using service to include furnishings, special equipment, troop labor, or similar related project costs. It is very important that the designer/cost engineer be aware of the PA and the various amounts and types of construction funds which comprise the PA, since the construction "contract" amount or construction cost estimate, plus all other allowances, must be within the PA.

### 3.2 Current Working Estimate (CWE)

The most current working estimate of the total projected project cost at a specific stage of design necessary to provide a complete and usable facility. It, like the PA, includes the Estimated Construction Cost (ECC) and all other allowances provided for in the PA. It is important to note that if a portion of the work authorized by directive is to be accomplished by a future contract, by other means, or otherwise withheld from the final design, requests for bids or contract award, then a proper allowance for the cost of this work shall also be included in the CWE. The CWE is continually updated during the life of the project (35%-Final) to reflect progressively more detailed levels of design effort which determine more accurately the expected final cost.

### 3.3 Construction Cost Limit (CCL)

The amount of funds, based on the PA, actually available for construction contract award, i.e., the Program Amount less contingencies, supervision and administration, and other allowances. It establishes the ceiling for the Government Estimate (including escalation). If the IGE should exceed the CCL, the project must be either redesigned, additional funds authorized, or bid additives, options established. **When the A-E negotiates the design contract it has accepted the responsibility for producing a design that will result in a project that can be awarded within the PA and CCL.**

### 3.4 Government Estimate (IGE)

A formal approved construction cost estimate prepared for contracting purposes. It represents the latest estimate of actual construction contract cost including escalation but excludes contingencies, supervision and administration and other allowances. An A-E prepared construction cost estimate does not become an "Official" IGE until approved by SAS Cost Engineering; however, the A-E shall treat the A-E prepared cost estimate as a "For Official Use Only" document regardless of its approval status.

### 3.5 Primary Facilities

These are the main facilities (buildings/structures/certain roads and pavements) in the project fulfilling the mission essential functions. The total estimated cost of primary facilities shall be estimated to include all construction costs (including earthwork) within five-feet of the structure(s), commonly referred to as the "five-foot line". Each facility shall have a separate quantity take-off and the facility costs estimated as a separate primary facility. Identical facilities may share the same "quantity takeoff"; however (except for family housing), each structure shall still be identified in the MII cost estimate as a separate facility. Near identical facilities may also share the same takeoff with the takeoff for one (or more) referencing the detailed takeoff for the other and noting the quantity variations only.

### 3.6 Supporting Facilities

Includes all costs outside the five-foot line such as private utilities, site work and all site improvements. Support facility costs shall be taken-off and estimated separately for each associated primary facility. The construction cost of items which serve more than one prime facilities shall be included with the facility which is most critical to the project as a whole, i.e., least likely to be dropped from the project as a result of budget constraints.

### 3.7 Life Cycle Cost

The sum total of the direct, indirect, recurring, nonrecurring, and other related costs incurred or estimated to be incurred in the design, development, production, operation, maintenance, support, and final position of a major system over its anticipated useful life span. Requirements for life cycle cost analysis are defined in the contract Statement of Work and/or AElS. The Architectural and Engineering Instructions specify which building systems require life cycle cost studies.

## 4.0 TECHNICAL SUPPORT SECTION FUNCTION

The cost engineering function in Savannah District is the responsibility of the Cost Engineer/Technician, Technical Support Section which reports directly to the Chief, Technical Specialties Branch. Responsibility and accountability for all cost engineering is centralized in this section. It is directly accountable and responsible for all cost engineering services provided on all military, environmental restoration and civil works projects designed in-house or under A-E Services contracts. A-Es are responsible for cost engineering services in accordance with the contract Statement of Work (SOW) and the instructions contained herein. The contract SOW takes precedence over these instructions in the event of a conflict. Cost Engineering's review, comments and or acceptance of A-E prepared cost estimates does not waive the Government's rights with regards to the A-E's responsibility for providing current, complete, and accurate cost engineering services, or the A-E's responsibility to provide a design within the CCL.

## 5.0 SCOPE OF COST ENGINEERING SERVICES

- 5.1 Planning, pre-concept, concept, and final design cost estimates shall be thoroughly documented to explain the basis of the estimate and to include contingencies associated with any unknowns or risk factors. If a portion of the work authorized by directive, and included in the PA, is to be accomplished by a future contract, by other means, or, otherwise withheld from the concept or final design, invitation for bids (IFB) or contract award, a proper allowance for the cost of this "deferred" work shall also be included in the CWE.
- 5.2 Estimates shall be based on the most recent design and site information available, and shall follow the format of the appropriate Work Breakdown Structure (WBS) to the assembly level (Level 6). Strict adherence to the specified work breakdown structure cannot be overemphasized as estimates must be developed in the required format in order to export or, import between the various software applications. Deviations from the specified WBS structure may be permitted for special applications, such as unit priced contracts.

There are three (3) separate Work Breakdown Structures, i.e., Military, Environmental Restoration, and Civil Works. The Military WBS shall be used for all vertical building construction whether Military Environmental Restoration or Civil Works funded. Environmental Restoration projects shall use the Hazardous, Toxic, Radioactive Waste (HTRW) WBS (funded by DERA, Superfund, DOE etc). The Civil Works WBS shall be used for civil funded projects such as beach nourishment, pump stations and large earth moving/dredging projects normally funded with non-military funds. Any questions concerning the proper format, application or work breakdown structure shall be directed to the Chief, Technical Support Section.

- 5.3 The final design estimate shall reflect the expected cost to the Government for performing the work by contract and be prepared in the same careful manner as if the cost engineer were bidding in competition with prudent, experienced, and well-equipped Contractors. All reasonable costs which a Contractor might be expected to anticipate and include in his proposals shall be included in the cost estimate.
- 5.4 The estimate shall reflect the local labor market (Davis Bacon wage rates are a minimum) and material prices anticipated or forecast to prevail in the vicinity of the project at the time the project is scheduled to be constructed. Davis Bacon rates are available on the network at the following address: [www.wdol.gov](http://www.wdol.gov). **A-E shall coordinate with Savannah District Technical Support Section for specific MII Labor Library prior to developing an estimate.**
- 5.5 The method used for preparing the estimate shall be in conformance with the requirements in section 6 below.
- 5.6 Should any question or clarification arise concerning procedures, the Savannah District Technical Support Section shall be contacted for clarification. Phone (912) 652-5521.

## **6.0 COST ESTIMATING METHODS**

### **6.1 Tri-Services Automated Cost Engineering System (TRACES)**

TRACES, comprised of several subsystems/modules provides a user friendly cost engineering platform, in a windows environment, with all the necessary subsystems and databases required to prepare, analyze, review and maintain all types of construction estimate and schedules. The U.S. Army Corps of Engineers currently mandates the use of some TRACES modules for specific cost engineering applications. Those subsystems currently on-line, including the applications which are mandatory, are described below. Estimates must be prepared following the specified WBS in order to facilitate the transfer of files between subsystems/modules. TRACES are available to A-Es and the Construction industry within the Construction Criteria Base (CCB) information system, which is available from the National Institute of Building Sciences, 1201 L Street, N. W., Suite 400. Washington D. C. 20005, (202) 289-7800; however, on request by A-E firm to the District Project Architect or Engineer (PA-E), The A-E must purchase the MII Cost book. Cost Engineering will furnish the latest version of any of the subsystems or databases not currently available in the CCB. In addition to the support databases (models, assemblies, crews, MII cost book, labor and equipment) provided with TRACES

#### 6.1.1 Micro-Computer Aided Cost Engineering System (MII)

A standalone detailed cost estimating system with the ability to estimate costs by creating or incorporating pre-defined models, assemblies and crews; or, by drawing from a unit price book, labor and equipment databases. It is a complete and comprehensive estimating program for the preparation of detailed or parametric construction cost estimates. MII is mandatory and shall be used by all in-house and A-E cost engineers for all concept and final design cost estimates unless specifically exempted by the Chief, Technical Support Section or the Commander. As of the publication of these instructions.

#### 6.1.2 Parametric Cost Engineering System (PACES)

This is a stand alone cost estimating system that uses pre-defined models and assemblies. The user has the ability to change or create models and assembly algorithms, and the added capability of transferring line items to and from a "quantity takeoff system", i.e., MII. Coordinate with the Chief of Cost Estimating (EN-ET) prior to use of the PACES.

#### 6.1.3 Historical Analysis Generator (HII – 2<sup>nd</sup> Edition)

A stand alone system that is capable of collecting, manipulating and extracting historical data. The HII database for each project includes a description of building systems, the cost estimate, and bid results in the required work breakdown structure. HAG is mandatory but is available for the cost engineer to compare current project costs with the estimate and bid results of similar projects. Coordinate with the Chief of Cost Estimating (EN-ET) as this data should be used a back check on the overall building unit cost and only accessed by the government.

#### 6.1.4 Life Cycle Costs (LCC)

A stand alone system capable of calculating the total cost of ownership (LCC) of one or more alternative (buildings, dams, etc.) facility systems (structural, mechanical, electrical, etc.), or components, and remedial clean-up efforts.

#### 6.1.5 PC Cost (PCC)

A stand alone cost estimating system which utilizes unit cost (\$/SF). It is used for preparing DD Form 1391 and ENG Form 3086. It will also convert parametric estimates to 1391 and 3086 formats and upload estimates to the PAX system.

#### 6.1.6 Cost Engineering Dredge Estimating Program (CEDEP)

A stand alone system used to produce cost estimates for dredging projects, in a standard format, for pipeline, hopper and mechanical dredging operations. This program is only available by the government.

#### 6.1.7 Risk Analysis (RA)

A stand alone system used to calculate cost estimating risks and determine needed contingencies during the planning phase or as directed. It has the capability to upload data from MCACES and includes a separate system for calculating contingencies factors for HTRW projects. A cost risk analysis shall be prepared for cost plus contracts and for contracts where quantities and or scope are not clearly defined. A Risk Analysis is required for all civil works projects over \$40 million. "Crystal Ball" software is used to produce a schedule/cost risk analysis.

#### 6.1.8 Remedial Action Cost Engineering and Requirements System (RACER)

A U.S. Air Force developed parametric model, windows based system for programming HTRW projects, which is required for project programming on U.S. Air Force HTRW projects. Optional for U.S, Army Corps of Engineers HTRW projects; otherwise, use MCACES or other cost estimating system approved by Chief, Technical Support Section. RACER is primary software for developing formerly used defense sites (FUDS) cost to complete (CTC) estimates.

#### 6.1.9 HAZRISK

Risk assessment software for HTRW projects based on historical data.

#### 6.1.10 HCAS -Historical Cost Analysis System

Database of completed HTRW projects to include cost associated with studies, design, remedial action and operations and maintenance related cost.

### 6.2 Manual Method of Cost Estimating

The manual method is rarely utilized anymore; however, if proposed for an SAS project, it shall be approved, in writing and in advance, by the Chief, Technical Support Section. Be advised that this is an exception rarely approved. When the manual procedure is approved for a project or specific submittal of a project, the estimate shall be prepared organized, and formatted using the appropriate TRACES template and work breakdown structure, i.e., Military, Civil, HTRW, etc.

The estimate shall be prepared utilizing the appropriate forms prescribed in UFC 3-740-05. At the ready to advertise submittal, the estimate forwarded to the Savannah District shall be the original prepared in pencil, in order that any necessary revisions by the Government may be readily incorporated.

### 6.3 Excel Spreadsheet Method of Cost Estimating

The spreadsheet method is also rarely approved; however, if proposed for an SAS project it shall be approved, in writing and in advance, by the Chief, Technical Support Section. Be advised that this is a rare exception. When the spreadsheet procedure is approved for a project or specific submittal of a project, the estimate shall be prepared, organized, and formatted using the appropriate TRACES template and work breakdown structure, i.e., Military, Civil, HTRW, etc. The format shall be for a "detailed" estimate to include, as a minimum, labor and equipment hours, rates and extended costs, and material quantities, unit and extended costs. Where appropriate, i.e., unit pricing/cost data is not available in Government or commercial estimating guides, lump sum amounts may be used.



At the ready to advertise submittal, the estimate forwarded to the Savannah District shall include the excel file on a compact disk (cd), in order that any necessary revisions by the Government may be readily incorporated.

## **7.0 COST ENGINEERING PERSONNEL REQUIREMENTS AND TRAINING**

### **7.1 Personnel Qualifications**

The designers cost estimating staff shall consist of dedicated full-time cost engineering specialist(s) for each required design discipline, such as architectural, structural, civil, mechanical, electrical, fire protection, corrosion engineering, etc. It is imperative that estimates be prepared and reviewed under the direct supervision of personnel who are competent in construction cost estimating. Estimators must possess a working knowledge of construction and be capable of making professional judgments based on experience. If the designer determines his staff does not possess all these qualification, he shall obtain assistance from a qualified firm whose specialty is cost estimating. Estimates prepared by a consultant must be reviewed by the designer before submission to insure accuracy, completeness, coordination and compliance with these instructions, and the contract SOW. A-Es shall assure that cost engineers have access to and are trained in the required computer hardware and software applications required to accomplish the cost engineering function. Where applicable, this includes life cycle cost analysis, cost risk analysis and parametric estimating techniques.

### **7.2 Training**

The Corps of Engineers and software vendors sponsor training in the required systems. Corps sponsored training classes are also available to A-E firms. A-E's are encouraged to utilize either Corps or vendor training where necessary to ensure satisfactory performance in the cost engineering function. The required software systems are complicated requiring either formal training or extensive practical experience to achieve an acceptable level of proficiency. Unless cost engineers proficient in the systems are used, submittal delays and re-submissions as a result of estimating errors are very likely.

## **8.0 GENERAL INSTRUCTIONS**

### **8.1 Additional Instructional Publications**

Cost estimates for all construction projects shall be prepared in accordance with the instructions and exhibits contained in this A-E Services Manual, UFC 3-740-05 Construction Cost Estimates and applicable TRACES Subsystem/Module User Manuals.

### **8.2 Cost Estimate Overruns**

It is the A-E's responsibility to design the project for a Current Working Estimate (CWE) that is equal to or less than the Programmed Amount. Proposed additives, options, etc., shall be identified at the concept design level and included, both in the quantity take-off and the cost estimate, as separate bid items accordingly. Should the project CWE exceed the programmed amount, the A-E shall provide a written narrative explaining the reasons why the CWE exceeds the programmed amount and offer proposals which would reduce the CWE within available funds. A written narrative shall also be submitted whenever the current estimate has changed more than 5% (plus or minus) from the previous estimate. In the case of concept estimates, variations of 5% from the DD Form 1391 shall be explained in narrative form.

### 8.3 Failure to Comply with Procedures

Failure of the A-E to conform to the procedures contained in this and referenced manuals will result in the estimate being rejected and resubmitted with the deficiencies corrected. If time is a critical factor, the A-E may be required to visit the District office within 48 hours for a face-to-face meeting and may be required to furnish a corrected cost estimate before leaving the District office.

### 8.4 Cover Sheet - Checklist

**THE CHECKLIST SHOWN IN EXHIBIT A, "COST ESTIMATE SUBMITTAL CHECKLIST" SHALL BE COMPLETED AND USED AS THE COVER SHEET FOR EACH COST ESTIMATE SUBMITTAL. Failure to complete and transmit this checklist will result in the estimate being returned.**

### 8.5 Estimates with More Than One Line Item

When the A-E's design contract includes more than one "Line Item Number," preparation of a separate detailed cost estimate and associated summaries for each line item is mandatory on all submittals. Site work associated with each line item shall also be estimated separately. This procedure facilitates the separation of cost in the event that a line item is deferred into another fiscal year or another program/project/bid package, etc.

### 8.6 Proposed Bid Schedule

#### 8.6.1 Bid Schedule

The A-E shall submit a proposed bid Schedule and IAW ECB 2007-19 submittal of Construction Data via the Historical Analysis Generator, paragraph 3; See Exhibit G, with each final and corrected final submittal. This schedule shall list all primary and support facilities separately.

#### 8.6.2 Additives and Options

When either additives, options are being considered, first consult with the EN-ET to determine the most advantageous to the Government or User. There are certain FAR requirements that have to be followed in the award process that causes one to be more advantageous than the other under certain conditions. A clearly defined (detailed) Scope of Work statement shall be included in the contract specifications, on the drawings or both for each additive/option to insure that all contractors are bidding on the same basis and to preclude varying interpretations between the Government and construction contractor concerning the scope of base bid and or alternates during construction. The "alternate" scope definition shall also be reproduced and provided to each cost engineer (for take-off and estimating purposes) and submitted to SAS with the proposed bid schedule for review purposes.

#### 8.6.3 Multiple Funding Sources

It may also be necessary to breakout items of different funding sources. The SAS USACE should be contacted in regards to this requirement. As with alternate bid items, a clearly defined (detailed) scope of work statement shall be included in the contract specifications, on the drawings or both for bid items covering different funding sources to insure that all contractors are bidding on the same basis, and to preclude

varying interpretations between the Government and construction contractor during construction.

## 8.7 Design Stage Identification

All sheets of the cost estimate shall be clearly marked as to the design stage (study, pre-concept, concept, preliminary, final, corrected final, etc.). The quantity take-off sheets shall be dated with any subsequence revisions annotated by date and initials. The design stage identity shall be entered in the "REPORT TITLE" field of the "PRINT SELECTED REPORTS" entry screen from the Report Menu of MCACES Software.

## 8.8 Copy Requirements

The summary and detailed cost estimate and all other exhibits and/or information required by this or referenced manuals/instructions shall be submitted electronically to the Chief, Technical Support Section, Savannah District and the Project Manager (unless the contract SOW specifies otherwise). Only one copy of the quantity take-off sheets need be submitted. It shall be organized by discipline and transmitted in a manner that will facilitate separation by discipline for review purposes. **Too often the cost estimate is transmitted without the take-off. The take-off is extremely valuable to the reviewer as it precludes our in-house cost engineers from having to perform redundant and separate take-offs to verify selected quantities. It also serves as a valuable tool when conducting VE studies. Due to time constraints, and the need to minimize review costs, the cost estimate will not be reviewed without the take-off and the omission of the take-off from the submittal will result in delaying the review process.** This requirement includes all submittal levels, including cost estimates for construction contract modifications. Electronic copies (compact disks) of the project and supporting databases shall also be provided for all submittals and transmitted in the same envelope. Access to all the databases allows SAS cost engineers to directly incorporate design changes, and corrections necessary to establish the CWE reported to higher command or addendum's prior to bid opening when there is insufficient time for returning the estimate to the A-E for this purpose.

## 8.9 Budgetary

The budgetary data furnished to the A-E is not to be considered restrictive, i.e., if the project scope of work, site conditions and design criteria result in a CWE in excess of the PA. The A-E is responsible for providing an economical design in the development of the site, structures and systems as well as the functional arrangements necessary to satisfy the scope of work, comply with the design criteria and user requirements for the project. Should the budget however be exceeded as a result of choosing poor economic systems, exceeding the scope or design criteria in general, the A-E shall be responsible for redesign without compensation. The District shall be notified of any proposed changes in project scope or design criteria as soon as the need for the change has been firmly established.

## 8.10 Quantity Take-off-General

### 8.10.3 Safeguarding

The quantity take-off, like the cost estimate, shall be treated in a confidential manner and only those personnel concerned with the preparation and/or review of the project shall have access. The take-off will be classified "FOR OFFICIAL USE ONLY." Such material cannot be divulged to other than accredited Government

personnel with a need to know. Information contained within estimates shall not be divulged to prospective bidders.

#### 8.10.4 Accuracy

The importance of an accurate and concise quantity take-off for the estimate cannot be overstressed, The quantity take-off for each bid item, except as defined herein, shall follow one of the following Work Breakdown Structures (WBS).

##### 8.10.4.1 Military WBS

Description: Except as provided herein, the Military WBS to Level 6 as provided in MII shall be used on all Military Construction Projects. This Military WBS is a hierarchy structure comprised of six levels: 1) Primary/Supporting Facility; 2) Facility; 3) System; 4) Subsystem; 5) Assembly Category; 6) Assembly, and followed by line item detail. Each system is divided into one or more subsystem which is further divided into assembly categories, then assemblies. Assemblies are made up of construction line items. The System, Subsystem, and Assembly Category Titles are rigidly defined and shall not be changed. Level 1 (same Level as Project Information Record) shall not be changed, i.e., two titles, Primary Facilities and Secondary Facilities.

Exception: The only exception to strict adherence to the specified WBS is in the development of unit price bid items, where the cost of an item might be spread over several systems, subsystems, assemblies, etc. and Means based cost estimates described in paragraph 6. Therefore, for some unit price items, it may be necessary to deviate somewhat from the WBS in order to capture all cost associated with that item under the appropriate bid item title. For example, a deep sewer utility project consisting of various size sewer pipes would include all cost associated with excavation, backfill, dewatering, shoring and laying pipe under each of the separate titles for each 8", 10", 12" pipe size, etc. For significant projects it will be necessary to further divide these titles into subtitles to account for varying materials and depths, i.e. 8" PVC Gravity 8' to 10' deep; 8" PVC 10' to 12' deep; 8" D.I. Force Main 8' to 10' deep; 4' Diameter Manhole, 8' to 10' deep; etc.

**WBS Guidance. Each building/structure support facilities, unit price item or bid alternate shall be taken off separately and defined at title level 2 in the MII estimate. By utilizing the separate building and support system take-off procedure it would be easier for Savannah District or the A-E, if necessary, to separate from the Base Bid the appropriate quantities and cost associated with unit price and Alternate bid items that might be identified late in the project Common support facilities shall be included with the building least likely to be identified as an additive or optional bid item. In no case, except for unit price items, shall the WBS title descriptions be changed for levels three through five. New titles for Subsystems or Assembly Categories shall be entered under the "Other" category. See the Military WBS. Note that the 01 through 15 Systems are for the interior of the building (5-foot line outside the building) and System 16 Selective Building Demolition fall under Primary facilities.**

**Systems 17 through 20 are exterior systems and fall under Support Facilities. For projects bid almost entirely by unit price, the A-E will likely have to revise the military WBS in order to create a WBS tailored to the proposed bid schedule. Consult with SAS Cost Engineer first.**

#### 8.10.4.2 HTRW Projects

HTRW (Hazardous, Toxic, or Radioactive Waste) Environmental Restoration Projects shall use the HTRW WBS. The HTRW WBS provides the framework for preparing cost estimates, modeling development, and collecting historical data for all remediation projects. The WBS consists of a numbering and title system that details the work to four levels of the WBS to organize the HTRW estimate. The quantity take-off shall be prepared following the WBS to the same level. In no case shall the WBS title descriptions be changed for levels one through four. Levels five and six shall be created to further break down systems of work into Assembly Categories and Assemblies, respectively. New titles for work not covered in the WBS may be added under numbers 90 through 99. Maintaining this rigid structure for the first four levels will allow systematic collection of historical HTRW costs. Any vertical building construction required within the HTRW project shall be a separate estimate from the environmental work and shall follow the Military WBS. HTRW projects will likely have two distinct phases; construction of a treatment facility and operation and maintenance of the facility over a period of time that may range from months to years. Construction and operation wage rates, escalation rates, and other cost may be different for construction vs. long-term plant operation. Therefore, construction cost will be prepared in a separate estimate from the "after construction" operations costs. Depending on the project scope, it is possible the A-E will be required to prepare three (3) separate estimates for each submittal one for the vertical building construction, one for the HTRW construction, and one for plant operations.

##### 8.10.4.2.1 Assemblies

An Assembly is a collection of individual cost items that function together as a single building/construction unit. For example, a 300 mm (12-inch) storm drainage line consists of excavation, backfill, compaction, layer of drainage gravel/bedding, 300 mm (12-inch) concrete pipe, etc. One unit of assembly contains a specified quantity and unit of measure of each included item. The Assembly has its own unit of measure. When the assembly is "linked" and the assembly quantity is changed, all included item quantities are changed proportionately. **The estimator shall maximize the use of Assemblies for all building and site work construction features. Estimating without Assemblies shall be the exception.**

## 9.0 DETAILED INSTRUCTIONS FOR QUANTITY TAKE-OFFS

### 9.1 General

The following procedures and exhibits must be followed in order for the A-E to present an acceptable quantity take-off and estimate. If a spot check of quantities by the District reveals inaccuracies, or the required WBS format has not been used in the preparation of the estimate, the estimate will be rejected and returned for resubmission with the deficiencies corrected.

### 9.2 Organization

Organization of Quantity Take-off is extremely important. It is essential that the take-off be started and organized based on the anticipated bid schedule, type of funds and the required Work Breakdown Structure; otherwise, much time will be lost attempting to transfer take-off quantities to the appropriate cost estimate bid item, primary or support facility, system, subsystem, assembly and detail item. The lead cost engineer, in coordination with the project manager, architect, and lead engineers must begin the take-off process by becoming thoroughly familiar with the WBS, then setting up the required MII Project Database title structure, i.e., one that will result in satisfying requirements to produce the estimated cost for each separate lump-sum and unit price bid item for each primary and support facility, different funding sources, additive and or options. Distribute this title structure in hard copy or electronic format to all cost engineer disciplines involved in the take-off and cost estimate. Unless you start in this manner you will face some real challenges later in trying to merge or otherwise

**Consolidate the individual discipline take-off or cost estimates. It is recommended that, until you become highly proficient with the required WBSs that a hard copy of WBS be used as a guide during the take-off phase.**

Quantity take-offs shall not be written and submitted on the drawings. The quantity take-off shall be prepared in a manner that is clearly legible, indicating the calculations involved in determining the quantity and any assumptions the cost engineer has made in determining the quantity. The take-off shall contain back-up or supporting sheets, if necessary, to support the breakdown of all material quantities contained in the design drawings and specifications.

### 9.4 Quantity Take-Off Sheet Heading

The top of each quantity take-off sheet shall contain the following information: 1) project information; 2) the design stage; 3) the plate number and/or specification number from which the quantity was derived; 4) facility name, quantity, and UOM; 5) WBS assembly code where the quantity should be located in the cost estimate; 6) the date and signature of the cost engineer who prepared them as well as the initials of the cost engineer who checked them.

### 9.5 Quantities at Five-Foot Line

The quantity take-off for each building and/or structure shall include quantities of materials to a line 5 feet outside the building line. Include site preparation and grading for the building area within this line. Include all cost outside the five-foot line in Support Facilities in the appropriate subsystem.

## 9.6 Earthwork Quantities

Compute earthwork quantities for site grading, roads, drives, utilities, etc., by the methods of cross sections or end area, or by utilizing software specifically designed for this purpose. For large earthmoving projects, cross sections, etc. for earthwork quantities shall be prepared and submitted with the quantity take-off sheets at concept, preliminary and final design submittal. For minor earthmoving projects, describe method and show calculations for cut and fill quantities. Copies of the cross sections shall be submitted with the concept and preliminary designs, while the originals will be submitted with the final design submittal.

## 9.7 Exceptions

The estimator shall coordinate with the Chief Technical Support Section for all exceptions to the above take-off requirements.

## **10.0 DETAILED INSTRUCTIONS FOR DETERMINING APPLICABLE WAGE RATES**

### 10.1 Wage Rate Calculations

Either the current Davis Bacon wage rates or current prevailing wage rates, whichever is greater, shall be used. The wage rate database provided will reflect the most current Davis Bacon hourly rate for the specific installation and includes most wage classifications and basic labor mark-ups for workman's compensation, taxes, insurance and benefits for a 40-hour construction week. It does not however include some highly specialized wage classifications nor does it take into consideration any abnormal circumstances such as a short term shortage of manpower in a specific trade in a local market which may have driven up rates, working in secure area, working in hazardous waste areas, or construction schedules requiring overtime or shift work, etc. The A-E shall be responsible for adjusting wage rates where appropriate and addressing any abnormal circumstances required by the project or local market and making corrections to the database rates provided reference Chapter 5 of UFC 3-740-05. Insurance and taxes on direct labor could be 20% or higher depending on project location and discipline.

### 10.2 Wage Rate Modifications

If the project requires that the A-E make changes to the Labor Database provided, the A-E shall modify the Labor Database provided to a new Labor Database for this specific project. An explanation of changes to the Labor Database shall be entered in a separate paragraph under PROJECT NOTES – titled EXECUTIVE SUMMARY. A printed copy of the wage rates used in the project will accompany the submission of each estimate. If a new Labor Database is created, it shall be saved when saving the MII project library and transmitted with the formal submittal.

## **11.0 OBTAINING EQUIPMENT/MATERIAL QUOTES**

Formal (written) or informal (telephone call memo) price quotes (preferred) or budget quotes shall be obtained on all principal items of equipment (such as concrete, cranes, elevators, kitchen equipment, pumps, compressors, unit heaters, air conditioners, fans, transformers, switchgear, etc.) and any specialty items (such as glazed acrylic canopies, metal pan ceilings, etc.) and all other large dollar items in the estimate and submitted as part of the estimate backup. These price quotations shall include a sufficient description (size, capacity, etc.)

of the item for evaluation purposes, the name of manufacturer, the date and the name, address, and phone number of the company supplying the quote. Price quotations shall contain the name of the company representative who supplied the quote and the time range for which the quote remains valid. A copy of all quotes/memos used to obtain pricing information shall be attached to the construction cost estimate.

## **12.0 DETAILED INSTRUCTIONS FOR DETERMINING INDIRECT COST OR FIELD OVERHEAD AND HOME OFFICE OVERHEAD**

### **12.1 Prime Contractors Field Office Overhead Mark-Up**

Indirect costs are divided into two categories, Field Overhead and Home Office Overhead (G & A), for field office overhead, the calculated (itemized breakdown) method of determining field overhead is required for 100% to RTA estimates. Percentages can be used for all others. It is essential that Division 1000 specification requirements be factored into field overhead requirements, i.e., requirements for Supervision, QC, Scheduling, As-Built, Project Signs, Temp Utilities, Safety, Portable Toilets, Trailers, Clean-Up (include dumpsters and disposal fees), Site Survey/Layout, Vehicles, etc. Items not applicable to this project shall be deleted and new items shall be added as required.

### **12.2 Subcontractor's Field Overhead**

A subcontractor's field overhead usually bears a fairly direct relationship to the subcontractor's portion of the work and can be estimated on a percentage basis. However, detailing of subcontractor's field overhead costs will be required for very large projects, where the subcontracted work has unique requirements, or where the cost impact of the subcontracted item is 25% or more of the total project direct cost. These percentages shall be used to determine when itemized overhead on subcontracted work is required and in assigning the weighted guide line factors to the Contractor's profit.

### **12.3 Typical Field Overhead Items**

**UFC 3-740-05, Chapter 5, lists typical items of indirect costs. This list is to be used as a guide for evaluating particular project requirements.**

### **12.4 Prime and Subcontractor's Home Office Overhead**

Home office costs are typically included in Government estimates as an average experienced percentage rate of the expected contract amount. It is important to understand that home office costs are not standard and fixed. The rate for a specific contractor varies from period to period. It is a function of total home office costs divided by the total volume of business during a specific period. A reasonable range of rates for general contractors subcontracting a large percentage of the work may average for estimating from 2% for larger to 7% for smaller contracts. A specialty subcontractor performing most of the subcontracted work will experience a higher G & A rate, from 8% for larger to 15% for smaller contracts. The amount of G & A is computed by multiplying selected percentage by the sum of the total direct cost plus field overhead. The Home Office Overhead shall be entered as a contractor markup.

## **13.0 DETAILED INSTRUCTIONS FOR DETERMINING PROFIT**

Allocation of Profit in Cost Estimates: The estimate will include allowances for prime contractor and subcontractor profit. For the prime Contractor and major subcontractors the rates for profit shall be determined by the weighted guideline method or percentages based on judgment of the estimator or Chief of Cost Estimating(EN-ET). Figure 11-1 of UFC 3-



740-05 is an example of the profit factor sheet. The applicable factors for use in preparing this form are shown in UFC 3-740-05, Chapter 11. The reason for the A-E selecting each factor shall be determined in the "Notes" of each Contractor.

#### **14.0 DETAILED INSTRUCTIONS FOR DETERMINING BOND**

The costs of performance and payment bonds will be included in the estimate. The rates shall be calculated using Class B bond. See UFC 3-740-05, Chapter 12 for setting instructions. No bonding shall be included for subcontractors.

#### **15.0 DETAILED INSTRUCTIONS FOR DETERMINING SUBCONTRACT WORK**

##### 15.1 Use of Subcontractors in Cost Estimate

**Estimates will be prepared for subcontractor work using the same methodology and degree of detail as outlined for the general contractor. The cost of subcontracted work is the amount charged by the subcontractor for the work performed, including costs for direct labor, materials, equipment, and second tier subcontracts as well as his charges for overhead and profit. The list of subcontractors indicated on the sample estimate for illustration only.**

##### 15.2 Use of Subcontractor Quotations

The Government Estimate will be prepared initially independent of subcontract quotes. When subcontractor quotes are obtained and validated, they may then be used to verify the reasonableness of the estimated subcontract work.

#### **16.0 SUBMITTAL REQUIREMENTS**

Civil Works and HTRW Estimates have unique submittal requirements A-E's should reference their Statement of Work for additional submittal requirements.

##### 16.1 Design Build Estimate for Request for Proposals

A-E's under contract to provide Design Build Request for Proposals shall provide an estimate based on a 10%-35% level of design. The building shall be estimated based on the level of available cost information since there is not a completed design to develop a Class 5 MII estimate. Accepted methods to estimate the building included unit cost from the following sources or combination of: historical bid information, Historical Analysis Generator (HII), adapt-build models, parametric estimating, and PACES Estimate. The supporting facilities should be estimated based on a detailed MII estimate from the provided design. Design Build Estimates should follow the work flow in 16.3 below. These estimates should be prepared and updated for each submittal based on the latest design changes, assumptions, and updated information.

##### 16.2 Pre-concept Submittal Requirements

16.2.1 Code 3 –Pre-Concept Design Program / Project Definition Report (PDR) The Code 3 Design Program (implemented for selected projects) will accelerate project design, intensify customer involvement, and produce a more accurate project budget utilizing parametric cost estimating techniques. It has been selected for application on certain types of suitable projects, such as those utilizing standard designs. The goal of Code 3 is to produce an accurate project definition which will result in a functional, durable,

economical and safe facility that meets the requirements of the customer, within pre-defined budget constraints and supported with a parametric estimate that can be submitted quickly to Congress using minimum funds. Once a project is approved it proceeds directly to final design (no pre-concept, concept or preliminary designs). Reference Architectural and Engineering Instructions for Project Engineering with Parametric Estimating.

- 16.2.2 On receipt of the Code 3 Directive a design team, including cost engineer(s), is assembled for the purpose of defining project scope and cost. The customer is also very much involved in this process. The cost engineer's role in this programming phase is twofold; 1) to provide quick cost estimates of the various alternatives that the team might consider while defining the final project scope; and; 2) to provide a final budget estimate. The cost engineer(s) involved in this process must be senior, i.e., with a thorough knowledge of parametric cost estimating and costs of various types of construction on a unit price, square foot or systems basis, in the vicinity of the project. Cost engineering requirements for this submittal will be defined in more detail in the scope of work.
- 16.2.3 Other Pre-Concept Level Study/Design Submittals. The pre-concept estimate shall be an MII or Parametric (PACES) estimate, and the format of the estimate shall conform to the appropriate Work Breakdown Structure. The pre-concept estimate will generally be used to compare life cycle cost or first cost of a number of alternatives prior to proceeding to concept design.

### 16.3 Concept (35%) Full Design Submittal

- 16.3.1 Concept Estimate. The concept estimate shall be an MII estimate and the format of the estimate shall follow the appropriate Work Breakdown Structure, proper allowances/contingencies shall be made for WBS systems and subsystems not completely defined in the concept drawings, outline specifications or design analysis.
- 16.3.2 **Funds. The concept estimate will be used to determine if the proposed design is within the amount of funds programmed for the project, and, if over budget, if redesign will be required, a reduction in scope required, or if the customer must pursue additional funding. Frequently these funds, once appropriated, cannot be increased. It is, therefore, imperative that this estimate include costs for every item that will be in the project, or a contingency amount provided for items not clearly defined at this point in the design. The A-E must be absolutely certain that the project can be built for the CWE developed from the concept estimate. During the concept design period, close cost control, consisting of coordination between designer and cost engineer, shall be exercised to achieve an accurate estimate.**
- 16.3.3 Quantity Take-Off. A complete and detailed quantity take-off and accompanying cost estimate shall be submitted with design. The quantity take-off and cost estimate shall be an accurate representation of the completed design submitted.
- 16.3.4 Corrected Concept Cost Estimate. Corrected concept cost estimates will generally be required to incorporate Technical Support Section review comments and scope changes occurring during the review process. The A-E

shall submit a corrected concept estimate if any design or other revisions have been made effecting scope of bid items or project cost. This estimate shall be prepared utilizing all the above described instructions and incorporating all the corrections, revisions, review comments, etc. All changes to the estimate shall be described and identified in the PROJECT NOTES. This estimate will be submitted in duplicate.

#### 16.4 Sixty- percent (60%) Design Submittal Requirements

16.4.1 General. Cost estimates for all construction projects shall be an MII type estimate generated by MII Software and prepared in accordance with instructions contained herein. Proper allowances shall be made for WBS systems and subsystems not completely defined in the preliminary drawings, outline specifications or design analysis.

16.4.2 Preparation. The cost engineer shall show all assumptions as to scope and design used in the preparation of the estimate.

16.4.3 Quantity Take-Off. A complete and detailed quantity take-off and accompanying cost estimate shall be submitted with the final design. The quantity take-off and cost estimate shall be an accurate representation of the completed design submitted.

16.4.4 Principal Equipment. In addition to the quantity take-off, the A-E's shall submit a list of the principal items of equipment and source of pricing (such as cranes, elevators, kitchen equipment, pumps, compressors, unit heater, air conditioners, fans, etc.), indicating the name of manufacturers and positive identification of items selected.

16.4.5 Evaluation. Special attention shall be given to the evaluation of the item General/Prime Contractor's Indirect Costs.

#### 16.5 Final (95% -100%) Design Submittal Requirements

16.5.1 General. Final design cost estimate for all construction projects shall be a detailed estimate generated by MII and prepared in accordance with instructions contained herein and in accordance with Exhibits A through E of this manual. Utilizing Assemblies of construction features.

The MII estimate format should match the Bid Schedule.

16.5.2 Quantity Take-Off. A complete and detailed quantity take-off and accompanying cost estimate shall be submitted with the final design. The quantity take-off and cost estimate shall be an accurate representation of the completed design submitted.

16.5.3 Principal Equipment. In addition to the quantity take-off the A-E's shall submit a list of the principal items of equipment and source of pricing (such as cranes, elevators, kitchen equipment, pumps, compressors, unit heaters, air conditioners, fans, etc.) and any specialty items (such as glazed acrylic canopies, metal pan ceilings, etc.) indicating the name of manufacturers and positive identification of item selected. Price quotations on all items listed above and on all other large dollar items in the estimate will be submitted as part of the estimate backup.

16.5.4 Indirect Field Overhead Costs. An itemized detailed list of field overhead costs shall be part of the final design estimate.

16.5.5 Profit Weighted Guide. The A-E shall use the profit weighted guide to prepare a detailed profit for the prime Contractor and major subcontractors.

## 16.6 Corrected Final Design Submittal Requirements

16.6.1 Notice. Corrected final submittals are not considered a normal design level and are required only when final submittals must be revised or corrected due to error or omission.

16.6.2 When to Submit. The A-E shall submit a corrected final estimate and bid schedule if any design or other revisions have been made effecting scope of bid items or project cost. This estimate shall be prepared utilizing all the above described instructions and incorporating all the corrections, revisions, final design comments, etc., made to the design since the final design submission. All changes to the estimate shall be described and identified in the PROJECT NOTES. This estimate will be submitted in duplicate with the corrected final design-submittal.

## 17.0 CWE SUMMARY CALCULATIONS REPORT(MILCON)

17.1 Preparation of CWE Summary Calculation Report. **Exhibit C** shows example of the format for a CWE Summary Calculations report. This summary report shall be prepared for all concepts, preliminary, final and corrected final submittal. The report shall be completed in accordance with instructions contained below.

17.2 Price Level. Use a price level of present day contract costs. The cost summary shall be escalated to the midpoint of construction. Army and/or Air Force escalation factors will be provided by the Technical Support Section.

17.3 Estimated Construction Time. The estimated construction time in calendar days, for the total project shall also be shown. Calendar days are entered in the "EST CONSTRUCTION TIME" field of the "REPORT TITLE PAGE" screen from the REPORTS Menu.

17.4 Contingencies. Exhibit D shows Contingencies at 5% of the Escalated Contract Cost, SIOH at 5.7% of the subtotal of the Escalated Contract Cost and Contingencies of the Escalated Contract Cost (ECC). The percentages vary from program to program and are subject to change. Currently the SIOH rate for MCA funded projects is 5.7%. All OMA funded projects will use a 10% Contingency factor, unless it involves "new" construction and currently use a 6.5% SIOH factor.

## 18.0 ADDENDUM TO BID SOLICITATION

18.1 During the bid period, any clarifications, redesigns, or other revisions to the plans and or specifications, which affect the final estimated construction cost by either increase or decrease in price, shall be analyzed for cost impact and submitted to Technical Support Section for appropriate adjustment in the GE. These revisions to the estimate may be either MCACES generated, Excel or manually prepared estimates as appropriate.

## **19.0 ACTION WHEN ALL BIDS EXCEED GOVERNMENT ESTIMATE**

- 19.1 After bid opening, if the bids received (to include apparent low bidder) are significantly higher than the Government's Estimate suggesting an unreasonable GE, there is a high probability that one or more bidders will protest the reasonableness of the Government Estimate.

Another situation occurs when the designer/cost consultants' final estimate is not within 15% of the low responsive bid at bid opening. If either situation occurs, the designer has a contractual responsibility to assist the Government in a detailed review and evaluation of the Government's estimate. The designer/cost consultant will promptly conduct an independent view of the GE at no additional cost to the Government. This includes a detailed review to determine if the GE contains any omissions, discrepancies (errors in calculations, et.), quantity takeoff errors, or errors in cost and pricing data. In addition, the reviewer should further analyze any unusual conditions or circumstances that may affect or complicate the work. If the reasonableness of the GE is protested, the analysis will consist of in-depth, point-by-point response to all issues raised by the protester or contractor. The review analysis will consist of the GE, including all backup and supporting data, complete explanation about assumptions made and, if available, historical data from previous similar projects which support the estimate. The GE should be revised immediately if an error is found, and an explanation of the error should accompany the revised estimate. If the revised estimate brings an offer's price within range of a fair and reasonable price, the Contracting Officer will review the situation and determine final contracting action.

## **20.0 CATEGORY CODES**

- 20.1 AR 415-28 identifies both Primary and Support Facility Category Codes. If the A-E contract scope of work requires that the Draft DD Form 1354 be prepared under the contract, then the Category Code Fields shall be completed and the Title quantities and UOM shall be consistent with AR 415-28. Otherwise, these fields need not be completed. Completing the Category Code Fields allows MCACES to interface with the software program which generates the DD Form 1354.

## **21.0 SCHEDULEING**

- 21.1 Project schedules will be provided for all projects with a project amount above \$40M. The A-E shall provide the schedule to the building system level or Work Break Down Structure Level 3 or 4. The schedule will be part of each submittal. Schedules will be submitted in PDF and raw format. The only acceptable programs to create the schedules Microsoft Project or P6 Primavera.

## 22.0 ORGANIZATION OF COST ESTIMATE SUBMITTALS & NO. COPIES

The submittal package shall consist of (depending on type submittal) and be submitted in the following order:

DOCUMENT(S)	NO. COPIES.
22.1 Title Page	2
22.2 Cost Engineering Checklist for A-E Estimate	2
22.3 Current Working Estimate	2
22.3 Statement of Cost Estimate Review	2
22.4 Quantity Take-Off Sheets (Separated by Facility & Discipline in Excel file)	2
22.5 Principal Equipment & Material Quotes	2
22.6 Other Back-Up Information	2

----END OF CHAPTER---

**CHAPTER 9**  
**TECHNICAL SUPPORT**  
**SECTION EXHIBITS**  
**DESCRIPTION**

- A. COST ENGINEERING CHECKLIST FOR A-E ESTIMATES
- B. CURRENT WORKING ESTIMATE NARRATIVE TEMPLATE
- C. CURRENT WORKING ESTIMATE TEMPLATE
- D. STATEMENT OF COST ESTIMATE REVIEW
- E. DETAILED PROCEDURES/INSTRUCTIONS FOR MII ESTIMATES

## Exhibit A

### Cost Engineering Checklist for A-E Estimates

2019 March 16

1. **General.** – The A-E shall prepare all planning, design, and final construction cost estimates, as specified below, utilizing Micro-Computer Aided Cost Engineering System (MII) Cost Estimating Software latest version.
2. **Detailed Work Tasks.** The A-E shall accomplish the following tasks:

#### Kickoff Meeting.

- Coordinate a one hour cost engineering kick-off meeting in within 14 days of NTP. Attendees will include USACE PM, USACE and A-E cost engineers, and cost peer reviewers. The agenda will include discussion of: estimate development, assumption documentation, quality control, acquisition strategy, and potential project cost constraints. For projects less than \$10,000,000, a conference call is acceptable. For projects greater than \$10,000,000, the meeting shall be held in person at the SAS District Office. The A-E shall send out meeting minutes following the meeting.

#### Prepare and Check Quantities.

- Develop a draft bid schedule for review and compute estimated construction quantities, including quantities for work that may be bid as lump sum items.
- Submit all computations necessary to support the bid schedule quantities and lump sum bid item work quantities in a report format.
- Prepare all cost estimates on the basis of calculated quantities and unit prices that are commensurate with the degree of design detail known or assumed. Building SF cost can be utilized for 35%-65% submittals if design is not far enough to support detail cost estimate (Level 5 and greater).
- Utilize project notes, added at the appropriate level in MII to explain the basis for quantity calculations, to clearly show contingency allowances, and to note quantities determined by cost engineering judgment that will be reconciled upon design refinement.
- Check quantities through an independent peer review procedure.

#### Prepare Cost Estimates.

- **Provide a copy of the A-E design team lead and cost peer reviewer comments and cost engineer responses with each submittal (comments/responses in email or Word are acceptable).**



- **Utilizing the 80/20 rule, 80% of the costs come from 20% of the items. Obtain current local quotes for these cost drivers. For remaining items, utilize MII to the fullest capability so that the government has the ability to adjust costs as appropriate in the future without contacting the A-E. Transferring cost estimates prepared using other cost estimating software or methods into MII as a lump sum is not acceptable and is cause for rejection of the estimate.**
- **Show source of cost information for all non-MII items (overrides, USR items, etc). Quotes should state company, phone #, date of quote and copy of quote. All data used for overrides and USR items must be well documented and obtained within 1 year of the estimate date. Include copy of quotes in each cost submittals.**
- Provide unique CSI numbers for user created items and back up quotes or costing support back up information. If used there must be auditable trail for the cost.
- The CWE scope items shall match the Section 00 11 00 - Solicitation/Contract Form bid schedule.
- Prepare detailed estimates for all aspects of the project utilizing MII estimating software. Utilize the latest version of MII with the latest Cost Book Library.
- Prepare the MII cost estimate utilizing HTRW, Civil Works, or Military templates as guides provided by the Chief of Cost Estimating.
- Assure the items in the Bid Schedule and cost estimate are the same, making it possible to cross- reference between the two and to easily determine the cost of each item on the bid schedule.
- Use labor, crew, and equipment databases and/or unit price book costs in the MII software program to develop a cost estimate for each bid item in the Bid Schedule. Most of the detailed items in the estimate should primarily be based on crews rather than the Unit Price Book (UPB).
- Provide notes in the MII estimate to document the assumptions and background information. The Estimator shall provide a list of assumptions that supports how the estimate was developed. This includes but is not limited to: derivation of profit and overhead markups for prime contractor and subcontractors, any design contingency included in the estimate, production and crew development methodology, labor, equipment, quantity take-off information, subcontractor quotes, and all other data used and identified in the MII estimate.
- Document and add distributive costs (i.e. overhead, bonds, profit) to each bid schedule item. Do not include as a separate activity in the MII estimate. Guidance for developing distributive costs can be found in Chapter 5 of ETL 1110-2-573 for Civil Works projects and Chapter 10 of UFC 3- 740-05 for Military projects. Clearly document the percentage assumed and rationale for each distributive cost. MII will calculate bond costs.
- Determine and document reasonable percentages for both field and home office overhead.
- Detail the costs for Civil Works mobilization and demobilization

- Determine and document a reasonable design and construction contingency percentage that will accurately reflect uncertainties in quantities and pricing. Guidance for design contingency development can be found in Chapter 6 of ETL 1110-2-573 for Civil Works projects and Chapter 13.5 of UFC3-740-05 for Military projects.
- Escalate the estimate to the expected midpoint of construction using the latest actual escalation rates(Turner CCI, ENR, etc) for Military Construction Projects or Civil Works Construction Cost Index System (CWCCIS) as appropriate.
- Consider site specific construction conditions during preparation of the estimate.
- Estimate major cost items which comprise a high percentage of the total job cost in detail using labor and equipment crews, production rates and supplier and subcontractor quotes, as applicable.
- Use current Davis-Bacon construction wage rates from <http://www.wdol.gov/>. or District provided  
MII Labor Data Base.
- Include the table of contents, summary pages, detail pages, backup pages for labor, crew, and equipment with the hard copy MII submittal.
- Provide an electronic version of the estimate (MII files plus all backup support).
- Wholesale escalation of the MII Cost Book and Equipment Library shall not be authorized. Utilize material quotes for Cost Book adjustments and equipment quotes Equipment Library adjustments. Any quotes received in development of the Project Estimate become property of the Government and shall be include in the project cost submittal.
- Utilization of prior project bid/proposal's shall not be authorized unless full disclosure is available to the Government and the hard copies are submitted as part of the cost submittal. If the A-E would like to utilize these bid/proposal's coordinate with the Cost Engineering Chief prior to submittal.
- Escalate the estimate to the expected midpoint of construction using the latest actual escalation rates(Turner CCI, ENR etc) for Military Construction Projects or Civil Works Construction Cost Index System (CWCCIS) as appropriate.
- Consider site specific construction conditions during preparation of the estimate.
- Estimate major cost items which comprise a high percentage of the total job cost in detail using labor and equipment crews, production rates and supplier and subcontractor quotes, as applicable.
- Use current Davis-Bacon construction wage rates from <http://www.wdol.gov/>. or District provided MII Labor Data Base.
- Include the table of contents, summary pages, detail pages, backup pages for labor, crew, and equipment with the hard copy MII submittal.

- Provide an electronic version of the estimate (MII files plus all backup support).
  
- Wholesale escalation of the MII Cost Book and Equipment Library shall not be authorized. Utilize material quotes for Cost Book adjustments and equipment quotes Equipment Library adjustments. Any quotes received in development of the Project Estimate become property of the Government and shall be included in the project cost submittal.
  
- Utilization of prior project bid/proposal's shall not be authorized unless full disclosure is available to the Government and the hard copies are submitted as part of the cost submittal. If the A-E would like to utilize these bid/proposal's coordinate with the Cost Engineering Chief prior to submittal.

## Exhibit B

## CWE Narrative Template

**Project Title****1. Project information**

Project Location:  
 Owner:  
 Designer:  
 Estimator:  
 Estimate date:  
 Estimator System:  
 Date of Report:  
 Cost book:  
 Equipment Library:

**2. Project Background****3. Project Markups**

Prime Contractor  
 Field Office Overhead (FOOH)                      Calculated or %  
 Home Office Overhead (HOOH):  
 Profit:  
 Bond:

Sub- Contractor  
 Field Office Overhead (FOOH):  
 Home Office Overhead (HOOH):  
 Profit:  
 Bonds:

Construction Start Date:  
 Estimated Construction Midpoint:  
 Estimated Construction Duration (Days):  
 Escalation:  
 Design/Estimating Contingency:  
 Sales Tax:  
 Specialty Mark-ups (Example: high security):

**4. Construction Duration.**

How was it determined?

**5. Cost Drivers**

Is there a secure area, etc.

**6. Assumptions**

Please address Productivity

Exhibit C

Current Working Estimate Template

U.S. ARMY ENGINEER DIVISION, SOUTH ATLANTIC  
CORPS OF ENGINEERS  
19-Dec-17

**REVISED CORRECTED FINAL (RTA) ESTIMATE OF TOTAL PROJECT COST**  
FOR  
**Training Facility**  
**FY - 2016 PN - xxxxx**  
**FORT BRAGG, NC**

This estimate is based on a Corrected Final (RTA) design package prepared by USACE Savannah District, dated December 2017 and a detailed MII Construction Cost Estimate prepared by USACE Savannah District Technical Support Section.

PROGRAMMED AMOUNT -----							<b>\$28,265,000</b>
	QTY	UM	UC	BASE BID	OPTIONS	TOTAL	
<b>CONTRACT COST - Present Day</b>							
<b>BASE BID (MCA Funded)</b>							
0001	Construct Advanced Skills Training Facility, Complete	64,865	SF	\$250.57	\$ 16,253,223		
0002	Site Preparation and Development, D Area Site, Complete	1	LS	16.21%	\$ 2,634,074		
<b>OPTIONS (MCA Funded)</b>							
0004	1 Construct Upgrade of Ardennes, Complete	1	LS		\$ 821,696		
<b>OPTIONS (OMA &amp; OPA Funded) [Not in TOTAL]</b>							
<b>CONTRACT COST</b>							
				\$ 18,887,297	\$ 821,696	\$ 19,708,993	
ESCALATION TO CONSTRUCTION MIDPOINT [2.0 x MCP Index]			4.24%				
MIDPOINT OF CONSTRUCTION(MCP INDEX) ----- Dec-18			2935				
CURRENT MCP INDEX ----- Dec-17			2874				
ESCALATED CONTRACT COST (ECC) -----				104.24%	\$ 19,689,054	\$ 856,577	
<b>SUBTOTAL ( EXPECTED PROPOSALS )</b>					<b>\$ 19,689,054</b>	<b>\$ 856,577</b>	
Contingencies -----				5.00%	\$ 984,453	\$ 42,829	
SUBTOTAL -----					\$ 20,673,507	\$ 899,406	
S&A(SIOH)-----				5.70%	\$ 1,178,390	\$ 51,266	
SUBTOTAL -----					\$ 21,851,897	\$ 950,672	
E & D (Percentage of ECC + \$110,000) -----				ECC X	0.25%	\$ 159,223	\$ 2,377
* Enhanced Commissioning (A/E) -----						\$ 200,000	\$ -
** Privatized Water and Sanitary Sewer Service (ONUS) -----						\$ 330,000	
** Privatized Electric Primary & Lighting (Sandhill, EMC) -----						\$ 250,000	
<b>CWE</b>					<b>\$ 22,791,120</b>	<b>\$ 953,049</b>	<b>\$ 23,744,169</b>
CWE / PA					80.63%		84.01%

\* These costs estimated by SAS Technical Support Section.  
\*\* These costs prorated from DD1391 by SAS Technical Support Section.

ESTIMATED CONTRACT DURATION - Construction 540 DAYS

PREPARED BY:

APPROVED BY:

\_\_\_\_\_  
xxx,xxxx, CCC  
xxxEngineer  
Technical Support Section

\_\_\_\_\_  
xxxx, P.E.  
xxxx,  
Civil Engineer

FOR OFFICIAL USE ONLY

Exhibit D

STATEMENT OF COST ESTIMATE REVIEW

Quantity takeoffs and the cost estimate have been completed for the project and phase stated below.

Notice is hereby given that (1) the design team lead was involved in developing quantity takeoffs and has performed a thorough review of all quantity takeoffs and (2) a peer review of the quantities and cost estimate has been performed by an independent (peer) cost estimator.

All items on the Cost Estimating Appendix for A-E Designs checklist have been completed and the completed checklist is attached.

Reviews included, but were not limited to: assumptions, quantities, methods, procedures, materials, alternatives evaluated, quotes received, the appropriateness of cost data used, and level of detail obtained.

During the development of the cost estimate, compliance with all required procedures and regulations was used.

QC peer review and technical review comments and responses on the cost estimate are attached.

PROJECT NAME

Project Phase (ex. 35%, 65%, 95%, 100%)

Design Team Lead\* (printed) (signature) Date

Cost Peer Reviewer (printed) (signature) Date

Cost Estimator (printed) (signature) Date

\*Design team lead review does not include price review (includes review of quantities, assumptions, etc. as stated above)

## EXHIBIT E

## DETAILED PROCEDURES/INSTRUCTIONS FOR MII ESTIMATES

NOTE: THESE INSTRUCTIONS ARE BASED ON MII 4.0. SEE MII USERS MANUAL.

### 1.0 Estimate Format

The format of all estimates shall follow the appropriate WBS (Military, HTRW, Civil) for the type estimate being created. The WBS should be studied in detail by all persons preparing the quantity take-off and the estimate. The WBS drives the way the quantity take-off will be prepared.

### 2.1 MII Software and Libraries

Current MII software and libraries can be provided by Savannah District. A-E must purchase a license to use the cost books. All libraries unique to Savannah District will have filename that begins with the first three characters "SAS" (South Atlantic Division Savannah District). All labor, equipment, and material costs provided in the cost libraries are a pricing guide only. It is the A-E's responsibility to check, verify and adjust labor rates, crew production material pricing and mark-ups where applicable for specific project conditions. All databases provided are FOR OFFICIAL USE ONLY and shall be protected accordingly.

### 2.2 Labor Rates Libraries

See paragraph 10 of this chapter for information about labor rates and any required change to rates. NOTE: Using the localized LABOR RATES will result in the correct hourly labor cost not necessarily the correct unit cost for labor. The correct unit cost for labor will be achieved after adjusting crew composition and crew productivity where applicable for specific project conditions. As the items of work are brought into the project database they are re-priced with the currently selected LABOR, EQUIPMENT, and cost library. The labor and unit cost shown in the cost library will not show the same cost when brought into the project because the library has not been re-priced to the localized LABOR RATES.

### 3.0 Templates

MII software includes templates. It contains specific project templates for each type of estimate. The appropriate project template shall be used to initiate the project.

#### Military Templates

**For Military Estimates the Project-Template-Military-v3 shall be used to create the estimate format. This template includes most of the TRACES GENERIC WBS to the lowest title level. This printout, along with the Military WBS will help the Cost Engineer create the estimate in the required format.**

#### 3.1.1 Military Estimate Hierarchy

When creating a MII estimate it is important to recognize that the construction project consists of seven hierarchical levels, some coming from ENG Form 3086 and some from the Military WBS.

They are defined as:

- LEVEL 0 (Top Most Level)... "PROJECT INFORMATION RECORD" LEVEL
- LEVEL 1 PRIMARY/SUPPORT FACILITIES (ALSO VIEWED AT THE PROJECT INFORMATION LEVEL)
- LEVEL 2 INDIVIDUAL FACILITIES AND ASSOCIATED SUPPORT FACILITIES LEVEL 3 SYSTEMS
- LEVEL 4 SUBSYSTEMS
- LEVEL 5 ASSEMBLY CATEGORIES
- LEVEL 6 ASSEMBLY
- LEVEL 7 DETAIL

#### 3.1.2 Project Level (LEVEL 0)

Level "0" is the Title "Project Information Record". All cost of the Primary Facilities and Support Facilities are accumulated to obtain a total project cost. This shall include all construction contract cost as well as Government-furnished materials and items furnished through funds other than construction funds, i.e., information systems.

#### 3.1.3 Primary/Support Facilities (LEVEL 1)

Level 1 is accessed on the same screen as the Project Information Record; however, the Level 1 Titles are listed below "Project Information Record." Level 1 divides the project into Primary Facilities, Support Facilities, Category E Equipment, and Government-Furnished Equipment based on DD Form 1391 format for the project.

#### 3.1.4 Individual Facilities (LEVEL 2)

Level 2 titles are included at the next "title level" below Levels 0 and 1, i.e., not the same screen. Individual Facilities/Buildings shall be listed under Primary Facilities and include all individual buildings identified by Category Codes in AR 415-28. If the project consists of more than one building in the same category code, each building shall be listed separately, even if the buildings are identical in size and scope. Support Facilities shall be listed separately for each primary facility. When Alternate bid items and items funded from different sources are required, they shall also be located at this level.

#### 3.1.5 Systems (LEVEL 3)

Under Primary Facilities the Military WBS Systems 01 through 16 are titled at this level. If there are multiple Primary Facilities, each one shall be broken down by the 01 through 16 Systems. Under Support Facilities the Military WBS Systems 17 through 20 are broken down under the appropriate DD Form 1391/Eng Form 3086 titles.



### 3.1.6 Subsystem (LEVEL 4)

This level contains the Subsystem titles from the Military WBS for the above Systems. If there are subsystems in the project not identified by the Military WBS, they shall be identified using 90 through 99 under the appropriate System.

### 3.1.7 Assembly Category (LEVEL 5)

This level contains the Assembly Category titles from the Military WBS for the Subsystems above. If there are Assembly Categories in the project not identified by the Military WBS, they shall be identified using 90 through 99 under the appropriate subsystem.

### 3.1.8 Assemblies (LEVEL 6)

Assembly Titles shall be created at this level following the definitions contained in the Military WBS.

### 3.1.9 Detail (LEVEL 7)

Individual Cost Items are located at this lowest level in the estimate and reports at this level are referred to as the Detail Reports. These are the basic work tasks consisting of labor, equipment and material cost and is the same level of detail as that found in the Unit Price Book Database. Some of the basic work tasks can be modified by Modifiers from the UPB.

#### 3.1.9.1 Modifiers

Modifiers are identified in the UPB database and provide a method of adding or reducing, for optional quality or scope to the work task costs. Each modifier acts solely on the basic cost item it is assigned.

## 3.2 Civil and HTRW Templates

**For Civil and HTRW projects the Project-Template-Civil-v3 or Project-Template-HTRW-v3 Template shall be used to create the estimate format.**

## 4.0 Required Services

The A-E shall supply the following Technical Support Section services.

## 5.1 Overall Project Analysis

The overall project shall be analyzed by all disciplines involved in preparing the cost estimate to consider the following procedure before making the detailed quantity take-off. This shall be done before preparing the concept estimate as it will dictate the final estimate format needed in the preparation of the quantity take-off.

#### 5.1.1 DD 1391

Review the drawings and DD Form 1391 for the project to determine the project scope, ensuring the authorized project scope is not exceeded. Should the DD Form 1391 contain vertical buildings that can be identified by AR 415-28 Category Codes (no matter how small), the A-E shall put these buildings under Primary Facilities in his estimate unless covered by a separate contract action and cost estimate. When multiple buildings are involved make each building as a separate Facility under the Primary Facilities. (Example: Tactical Equipment Shop which has POL, Storage, and Sentry Buildings). When multiple buildings are being constructed at different sites the A-E shall prepare a separate facility for each building in the Primary Facility and separate Supporting Facilities for each building site. The A-E shall prepare a proposed Bid Schedule based on the Facility (Level 2) of the Primary Facility and the Support Facilities (Level 2) for Site Work.

#### 5.1.2 Buildings

When the number of buildings has been defined in the Primary Facility, each of the buildings shall follow the WBS of defined Systems, Subsystems, Assembly Categories, and Assemblies. The Detail Quantity Take-off shall follow this same format.

#### 5.1.3 Funding

When projects are funded by more than one funding source, all work related to each funding source shall be segregated respectively. Funding sources shall be identified separately at Level 2 in the MII estimate and shall be identified separately on the proposed Bidding Schedule. All work associated with each funding source shall be described on the plans and/or specifications in narrative to facilitate contractors bidding on the same scope of work for each bid item.

#### 5.1.4 Army Projects

For Army projects, all information systems that are funded by OPA shall be a separate Bid Item in accordance with AR 420-1 provided in other documents. These systems shall be identified as specified in paragraph 5.1.3 above. This is not required for Air Force Projects.

#### 5.1.5 Cost Estimate

See Exhibit A, Create New Project Checklist for detailed start-up procedures. If the cost estimate is to be prepared by more than one person on more than one computer and then merged into one Prime Estimate, please contact EN-ET for procedure to merge Multiple Project Databases.

- 5.2 Sales Tax on Materials. Use the applicable state sales tax based on project location. For projects excluded from sales tax, i.e., certain environmental projects exclude taxes where appropriate and provide a note accordingly in the project information notes screen.

5.3 Owner Markups. Set Owner markups to be applied at Level 01. This precludes owner markups from being applied to project costs that may not incur owner mark-ups such as Army communications costs, Government Furnished\Government Installed Equipment, etc.

5.3.1 Contingencies and SIOH. The A-E shall include contingencies and SIOH in the CWE only, not in the MII (EN-ET) file.

5.3.2 Escalation. The estimate shall include appropriate escalation factor. Contact Technical Support Section for appropriate Indexes.

## 6.1 Starting the MII Project

MI software and libraries should be installed as described above. Activate the MII software following instructions from the MII Software Manual. Before starting the project ensure that the appropriate Project Templates and Databases are selected. Reference Exhibit A, Create New Project Checklist.

## 6.2 Military WBS projects

6.2.1 For Military WBS Projects the Project-Template-Military-v3 Template shall be selected and copied as described above in paragraph 3.1.

6.2.2 With the new project highlighted press Library Properties and enter the official description of the project title.

6.2.3 See Exhibit A; Create a New Project Checklist for Project Notes instructions.

## 6.3 Subcontractors

The subcontractors' profit may be either fixed or calculated by the Profit Weighted Guideline for the "OTHER" window as was done for the prime Contractor. In order for Contractors to be used in the estimate they must be assigned at the appropriate level within the Primary/Support Facilities.

## 6.4 Primary Facilities Title

On the Primary Facility Edit Screen the quantity shall be LS (Lump Sum). Usually the prime Contractor ID "Prime Contractor" is entered on this screen as he is usually the prime on all Facilities under Primary and support Facilities. Project Category Code (from DD Form 1391) is typed into the Category Code Field, unless there are more than one Primary Facility at level, in which case category codes should only be entered at Level 2 titles.

## 6.5 Facility Titles

Create the number of Primary Facilities that was determined from paragraph 5 above. To create another Facility highlight FACILITY if there are two or more identical or very similar facilities, recommend that you complete the detailed estimate for the first typical facility before you create a copy the next one. By doing this you will only need to make minor revisions (if any at all) to create the complete cost estimate for the similar facility. Continue this process for all Primary Facilities in the project. Type in the name of the Facility, and Gross Square Feet of the Building as the Facility Quantity, UOM, and insert the Facility Category Code (from DD Form 1391 or AR 415-28) into the Category Code Field. Also see the quantity and UOM consistent with AR 415-28. If the prime Contractor was defined on the PRIMARY FACILITIES TITLE leave the Contractor Field blank. Use the same basic procedure to define all the Support Facilities for each building at Level 2 under Level 1 Support Facilities title.

## 6.6 System Titles

System Titles and Selective Demolition System are pre-defined and the titles shall not be changed. Each shall be edited to enter, the appropriate quantity as defined in the WBS. Any SYSTEM TITLE not used in the project shall be deleted. Sometimes subcontractors can be identified at the Systems Title level as all work performed in the system is normally accomplished by one Contractor. For example System 11 - Electric Power and Lighting is normally installed by the Electrical Contractor "EL." By identifying the "EL" contractor at this title level you need not identify this subcontractor at any level below this, as it is done automatically by the program.

## 6.7 Subsystem Titles

The Subsystem Titles are pre - defined and the titles shall not b changed. Each title shall be edited to enter the appropriate quantity as defined in the WBS. When there are Subsystems in the project which are not defined in the WBS the A-E shall create them using 90 to 99 Identification code. Any SUBSYSTEM TITLE not used in the project shall be deleted. Subcontractors can also be identified at the Subsystem Title level if all work performed in the subsystem is normally accomplished by one Contractor.

## 6.8 Assembly Category Titles

The Assembly Category Titles are pre-defined and the titles shall not be changed. Each title shall be edited to enter the appropriate quantity as defined in the WBS. When there are Assembly Categories in the project which is not defined in the WBS the A-E s all creates them using 90 to 99 Identification codes. Any ASSEMBLY CATEGORY TITLE not used in this project shall be deleted. Sometimes subcontractors can be identified at the Assembly Category Title level as all work performed in the category is normally accomplished by one Contractor. For example System 6 - Interior Finishes; Subsystem 01 -Wall Finishes; Assembly Category 03 - Gypsum Wallboard Finishes is normally installed by GW-Contractor and Assembly Category 04 - Tile and Terrazzo Wall Finishes is normally installed by the - Contractor.

6.8.1 When Assemblies can be used multiple times within the project it is beneficial to the cost engineer to create the Assembly in the MODEL's DATABASE rather than in the project. Assemblies from the MODEL's DATABASE can be copied into the project as often as required. The A-E shall copy the SAS Generic Models Database using Copy a Database on the SERVICES Menu to the same six characters as was use to name the project. Select this new Model's Database and uses it to create new assemblies. This new Models Database shall be submitted along with the project database with each submittal. See paragraphs 8.9 and 16 of this chapter for submittal requirements.

## 6.9 Assembly Titles

The SAS project template contains typical Assembly Titles (without detail items) associated with military construction. The A-E shall revise the Assembly Titles by deleting inappropriate titles and adding titles based on the requirements of the project. The TRACES GENERIC WBS provides a description of detailed items found in the assemblies. If it is necessary to add Assembly Titles, follow the instructions in User Manual.

## 6.10 Support Facilities Title

In most projects there is only one set of Support Facilities (only one Primary Facility is constructed on the site). When there is only one set of Support Facilities these title record needs only to be edited to identify the Prime Contractor.

## 6.11 Adding Additional Support Facilities

Occasionally there are projects that contain multiple Primary Facilities, or a project may consist of more than one site and due to scope and or criteria changes or budget constraints, it is not uncommon that one or more buildings may be isolated as alternate bid items. For this reason it is necessary to takeoff and estimate support facilities for each primary facility separately. Therefore, when more than one primary facility occurs, Bldg. No. 1 Support Facilities Title shall be duplicated for each primary facility. To create another Support Facility highlight copy/paste and rename. Continue this process for all Support Facilities in the project. Edit each support facility title to mirror the primary facility title to the extent that the right support facility cost can be easily related to its primary facility.

6.12 Category Codes for Support Facilities. Refer to AR 415-28 to identify the category codes associated with support facilities, i.e., all applicable 800 and 900 Series numbers. Once all applicable codes for the project have been identified, enter the category code at the appropriate title or detail level which will result in capturing all related cost for that code. And make sure the quantity and UOM at this title level are consistent with AR 415-28.

## 7.1 Print Selected Reports

The following procedures shall be required by the A-E when creating the required printed reports for all submittals.

## 7.2 Select Required Reports

MII software includes standard Corps reports. Ensure project properties includes name AND telephone number of the cost engineer responsible for preparation.

## 7.3 Activate Reports Generator

From the REPORTS Menu open standard Report, type in the estimate design status (Concept, Final, etc.) in the Report Title Field.

### 7.2.1 Send Reports to Print

MII prints to .pdf

## 8.0 Compact Disk Labels

The following information shall be recorded on all compact disk submitted to Savannah District. Project Identification Code (6 character code) and the design status, i.e. "60% Estimate".

Project Title  
Project No.

\*\*\* End of Section \*\*\*

## CHAPTER A-10

Revised July 2020

### DRAWINGS

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## CHAPTER A-10

### DRAWINGS

#### 10.1 GENERAL.

10.1.1 Purpose and Scope. This chapter sets forth criteria and standards to enable designers and drafters to prepare a clear, uniform set of design drawings and illustrations. Unless specifically noted in the A-E's scope of work, the standards for drawing presentation contained in this chapter shall be used in the preparation of all drawings required in a contract. Drawings shall be prepared with the expectation that the construction will be able to construct the facility without any additional assistance and/or without the necessity for modifications to correct design deficiencies. Drawing submittals shall also be detailed to the extent that an accurate cost estimate can be prepared and shop drawings can be checked. Special consideration has also been given to the reproduction processes, and plotting equipment. If Building Information Modeling (BIM) is required, Chapter A-16, Building Information Modeling sets forth criteria and standards for preparation of a complete and functional BIM model.

10.2 **APPLICABLE PUBLICATIONS.** The publications listed below, hereinafter referred to by basic designation only, shall be used when preparing drawings. In each case, the most current edition existing at the beginning of the design shall be used.

A/E/C CAD Standard Release 6.1 dated August 2019 and Graphics Standard Release 2.1 dated August 2019 available on Internet at

<https://cadbimcenter.erdcdren.mil/default.aspx?p=a&t=1&i=2>

**NOTE: The A/E/C Work Structure at the above website is a common environment that can be used across agencies and engineering applications. This environment contains folder structures, tools, and resource files that implement the A/E/C CAD Standard and the A/E/C Graphics Standard documents. By utilizing one environment across agencies and applications it will give greater consistency when delivering A/E/C Standards-compliant deliverables.**

ER 1110-1-8152 Engineering and Design Professional Registration and Signature on design documents dated 24 January 2012

#### 10.3 COMPUTER AIDED DESIGN (CAD).

10.3.1 CAD Requirements. The following CAD file requirements will apply:

- a. The design drawing files shall be created using guidance provided herein. The CAD Details Library provided by the CAD/GIS Technology Center should be used as much as practicable. The A/E/C CAD Standard Release 6.1 is provided by the CAD/BIM Center to set forth standards that will provide a consistent and compatible platform for CAD system use Corps-wide. The establishment of a uniform CAD platform will provide a means for rapid, accurate transfer and integration of virtually all project-related information throughout the life cycle of any building project or facility master plan. Savannah District has chosen to make Autodesk Revit the



- system of record for vertical design and Bentley MicroStation the system of record for horizontal design and all other projects. All translations from other systems to assure compatibility must be the task of the A-E firm and not of Savannah District personnel.
- b. As a **minimum** each drawing in a design shall have an electronic file copy. Only **one** drawing should occupy an electronic file. With very few exceptions, all drawings will be plotted black and white.
  - c. A key plan should be displayed on each plotted drawing that depicts topographic information or plans that are broken due to size and scale.
  - d. The **electronic files** should be saved with the composite drawing (drawing as it is to be plotted) in View 1.
  - e. All referenced files are to be attached without drive or directories (**no paths**). All reference files must be in the same directory as the sheet file in electronic deliverables. The electronic file naming convention begins with 3-digits provided by the Data Management Section referred to as the Project Code. This Project Code is provided within the Specific Instructions provided at the beginning of any design effort for Savannah District. The Data Management Section is the proponent of this action.
  - f. The files making up the Electronic Bid Set (EBS) are PDF files. Each electronic file is named for SHEET ID of the drawing. (Example G-001.pdf, VF101.pdf, T-101.pdf). For projects with multiple buildings, the BUILDING ID shall be added to the file name to differentiate between drawings with the same SHEET ID. (Example A-101TEMF.pdf, SB101HQ.pdf, etc.) In addition, files for multiple buildings shall be organized into folders. No two files for a project shall have the same name. Furnish spreadsheet or text file containing list of all PDF files by PDF filename, SHEET ID & drawing titles. File shall also illustrate folder organization for projects with multiple buildings.
  - g. The **electronic file name** should be displayed on each drawing, and on the Index in the space labeled "filename".
  - h. Civil site and TOPO drawing CAD files:
    1. Civil site and TOPO drawing CAD files shall use the seed files available from the Savannah District Engineering Criteria web site - <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx>
    2. All drawing elements shall reside on appropriately named levels/layer, in accordance with the 6.1 A/E/C/ CAD standard.
    3. All polygons shall be cleaned and free of duplicate vertexes and self-intersections.
    4. On the civil site plans, label all existing structures with a building number, even when they are scheduled for demolition.
    5. On the civil site plans, all streets shall be labeled with the street name.
    6. All site plans are to be displayed with North to the top of the sheet. Due North on the map will be as viewed from the bottom of the map.
    7. All site drawings will have exactly the same match lines.
    8. Pertinent survey information must be present on the existing topography; datum, date, survey method, and surveyor name.
    9. The **site layout plan** needs to clearly identify the construction limits of the project. The resulting CAD file will be a singular file depicting the **project site layout** with a closed polygon depicting the construction limits. The construction limits polygon will reside on an individual layer named **C-PROP-CONS** per the 6.1 A/E/C CAD standard AIA format with the Level/Layer

Description of **Construction limits/controls, staging area**. Depiction by symbology alone is not acceptable. The construction limits should include all areas of expected disturbance – grading, clearing, erosion control, utilities, etc.

10.3.2 CAD Deliverables. The requirements of the CAD drawing **deliverables** are itemized as follows:

- a. As a minimum each drawing represented in a design should have an electronic file. The acceptable software shall be identified in the specific instructions for each project as determined by the customer's requirements; Currently Bentley MicroStation (.DGN) and Autodesk AutoCAD (.DWG) are the acceptable electronic file formats. Any supporting resource files, pen tables, plot drivers, cell and font libraries must also be furnished to the Savannah District with the electronic files. All work should be completed using default settings with no specialized font or line styles. All resource files furnished by the A/E/C CAD Center are considered default.
- b. Furnish PDF files of all drawings at each submittal stage in addition to binder PDF files of each drawing set or volume, if applicable. Each drawing should occupy one PDF file and should be named by the SHEET ID, G-001.pdf. VF101.pdf, etc. (and BUILDING ID, if applicable.) Each binder PDF drawing set should be named to include the PN, submittal stage, and volume, if applicable. (Example PN12345\_60%\_VOL1.pdf).
- c. A text file or spreadsheet listing each electronic PDF file name, SHEET ID, and drawing title should be included with the electronic drawing. The electronic media used for delivery should be CD or DVD created with a drive adhering to **ISO 9660**.

10.3.3 CAD Standards. The A-E shall comply with the 6.1 A/E/C CAD Standard from The CAD/BIM Center. The web site for the standard is <https://cadbimcenter.erd.c.dren.mil/default.aspx?p=a&t=1&i=2> .

10.4. **SUBMITTAL REQUIREMENTS.** The arrangement by drawing discipline is given in Exhibit A-10-9 of this manual. Specific technical requirements for these submittals may be found in the individual chapters of the respective technical disciplines. Electronic files should be submitted for technical adequacy review at each submittal stage. Submit all the CAD drawing files with a hard copy submittal to the Project Manager. CAD drawing files must be submitted in MicroStation DGN or AutoCad DWG based on contract requirements, and PDF format. Only one set of the CAD files is required. Each electronic drawing submittal package must display a label with:

Base name  
Project name  
CAD # \_\_\_\_\_  
Design submittal phase  
Firm Name

10.5 **FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS.** The drawing guidance given in this chapter is applicable to the Final (100 Percent) Design submittal. Additionally, it should be noted that all title block information (titles, SHEET ID, category code, solicitation no, etc.) must be complete in the Final (100%) Design submittal. Specific technical requirements for this submittal may be found in the individual chapters of the respective technical disciplines. This submittal shall include **all** electronic files necessary to display every drawing for the design. CAD drawing files must be submitted in MicroStation DGN or AutoCad DWG based on contract

requirements, and PDF format. A hard copy plot of each drawing must also be submitted to the Project Manager. Only one set of the CAD files is required. Each electronic drawing submittal package must display a label with:

Base name

Project name

CAD # \_\_\_\_\_

Design submittal phase

Firm Name

## 10.6 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.

10.6.1 Notice. In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

10.6.2 General. The drawing guidance given in this chapter is applicable to the Corrected Final Design submittal. This submittal shall include **all** electronic files necessary to display every drawing for the design. CAD drawing files must be submitted in MicroStation DGN or AutoCad DWG based on contract requirements, **and** PDF format. A hard copy plot of each drawing must also be submitted to the Project Manager. Only one set of the CAD files is required. Each electronic drawing submittal package must display a label with:

Base name

Project name

FY, Line Item

CAD # \_\_\_\_\_

Design submittal phase

Firm Name

## 10.7 MATERIALS.

10.7.1 Drawing Media. Drawings shall be plotted on bond paper, English Inch Pound Unit Projects drawing size ANSI D (22" x 34" overall) or Metric Unit project drawing size A1 (841 x 594). Savannah District Data Management Section provides these borders, title blocks, and zoning to A-E's. A new border sheet file should be obtained each time a new project is begun due to changes in border requirements.

10.7.2 Other Media. There are various electronic files available from Savannah District, Data Management Section. The A-E should request CD with files through the Project Manager, or ask for the current Web page where they can be found. Files are available for use with Bentley MicroStation and Autodesk Revit. Formats available on CD are the following:

- a. Border Sheets
- b. Cover Sheet
- c. Combination Cover/Index Sheet (for jobs with 50 or less drawings)
- d. Index of Drawings (for use with Cover Sheet)

- e. Location Plans (not all Installations have electronic files)

### 10.7.3 General Requirements.

- 10.7.3.1 All drawings will be prepared electronically with software compatible and approved by Savannah District, unless a special waiver has been obtained from Project Management. Color plotting is not acceptable for contract drawings.
- 10.7.3.2 Excessive patterning should be avoided. Associative patterning or hatching should be used for area patterns and line styles should be used in lieu of linear patterns. The use of multiple line placements to depict line width is not advised. Shading should be used sparingly. Any characteristic that is dependent on plotting software should be avoided. The drawings become the property of the users and each have different plot configurations.

## 10.8 DRAWING PREPARATION.

- 10.8.1 Drafting Standards. All line work, text, symbolizing, and other aspects of drafting shall be accomplished in accordance with standard drafting practices. Consistency is essential throughout the drawing set; from one discipline to the next the drawing appearance (text size, font, case, line weight consistency, etc) should be constant. Complete legends of symbols and lists of abbreviations shall be included on the drawings for all submittals so that their meanings are clear. Key plans and match lines should also be used.
- 10.8.2 Half-size Reduction. Particular care shall be exercised to insure that all work is prepared for half-size printing. Congested areas should be enlarged to a suitable scale. For any sheet or part of a sheet not meeting this standard, the designer will be required to promptly re-scale and resubmit, at no additional expense to the Government, a new drawing which is completely readable when reduced half size.
- 10.8.3 Drawings Incorporating Photographs. Certain project drawings (e.g., operations and maintenance work, rehab projects, etc.) may be best portrayed by use of digital or scanned photographic images of the actual buildings or aerial photographic site plans. This method may be used only if the text and line work is placed on a separate level from the basic photograph. (The border and title block should be a reference file to the photograph.) Also, those portions of the photograph, which lie beneath the text and/or line work, must be removed in order to ensure clarity and readability of the composite drawing.
- 10.8.4 Line Weights. Line weights are illustrated in the 6.1 A/E/C CAD Standards. Additionally, special care should be taken to distinguish between new and existing work. Line weights for new work shall be heavier than for existing work where they both occur on the same drawing. Only the line weight variations can effectively distinguish between new and existing work on the full-size prints. Scale and space permitting, a separation of three line weights will be used to distinguish new from existing.
- 10.8.5 Text. The NCS recommends that the minimum text height for plotted CAD files is 3/32 in. (2.4 mm). However, to maintain legibility in half-size drawings, most sites go no lower than 1/8 in. (3 mm) in text height for dimensions, notes, callouts, table/schedule text, and general text on full size drawings. Subtitles and titles shall be plotted equivalent to 3/16 in. (5 mm) and 1/4 in. (6 mm) lettering size, respectively. The text height and text

width shall be assigned equal number values. Line spacing shall be equal to one half of the text height. Refer to Table 5-1, 2.0 Graphics Standard for comparison of font types to be used.

## 10.9 DRAWING FORMATS.

10.9.1 General. All projects shall have a cover and an index sheet or a combination thereof. If Savannah District is providing the soil borings, reserve some space on the index plates for the soil boring sheets. Refer to table EXHIBIT A-10-9 for discipline organization per discipline designator.

10.9.2 Title Blocks. Exhibits A-10-1 through A-10-3, filled-in title blocks as indicated below:

Exhibit A-10-1	A-E Title Block- Sheet Identification and Project Information Block
Exhibit A-10-2	A-E Title Block- Management Block
Exhibit A-10-3	Sample Revision Block

10.9.3 Numbering System. The explanations given below refer to numbering required in title blocks.

10.9.3.1 The Solicitation Number is a unique, alpha-numeric number set which denotes the specific construction bid solicitation. Due to Government contracting requirements, this number is not available until final or corrected final design submittal. Plan to add this number to all drawings under SOLICITATION NO. in the title block prior to your last submittal. The Solicitation Number should also be placed on the Cover Sheet.

10.9.3.2 The Category Code Number, reflecting Army and Air Force criteria, defines facility classification category code, and the sequence for that type facility. This unique seven-digit number set should be added to the border sheet where indicated. This number will be furnished within the Specific Instructions for CAD.

10.9.3.3 The SHEET ID assigned to each drawing is defined in the A/E/C CAD Standard.

10.10 **DRAWING REVISIONS.** In general, the designer/drafter may be involved in revisions to drawings during solicitation and during construction. Revisions during solicitations are referred to as **amendments or revisions**. Revisions during construction are referred to as **contract modifications or modifications**. The methods and procedures for reflecting these changes on drawings are described below and the notation is illustrated in Exhibit A-10-3.

10.10.1 Amendment/Revision Drawings for Solicitations. **All amendment revisions to drawings are made by issuing revised drawing(s).** Use the very bottom space in the revision block and identify it as Revision 1, or the next sequentially higher number for that drawing. Thus, the revision numbers for a given amendment/revision may vary from drawing to drawing and will not necessarily match the amendment/revision number itself. All revised drawings will be annotated by symbol (triangle) on the drawing at the point of revision and will carry a revision number, which will be shown in the column headed "Mark" in the revision block of the drawing. A brief description "**REVISED IN ACCORDANCE WITH AMENDMENT 000#**" will be entered under "Description" in the drawing revision block. Revisions to drawings for Task Orders will be as explained for Solicitations with the exception in the Description. The description will read "**REVISED IN ACCORDANCE WITH RFP LETTER\_R#**".

10.10.2 Added Drawings. For sheets to be added by amendment, the revision block will be annotated "**SHEET ADDED BY AMENDMENT 000#**" at the "Description", no number should be placed in the symbol area. Added sheet titles and other information will be a revision to the Index of Drawings sheet. For sheets to be added by revision for Task Orders will be as explained for Solicitations with the exception in the Description. The description will read "**SHEET ADDED BY RFP LETTER\_R#**".

10.10.3 Deleted Drawings. For sheets to be deleted by amendment or revision, the drawing will be deleted from the set. Sheets deleted by amendment or revision will be shown as "Deleted" on the Index of Drawings sheet and noted as a revision to the Index of Drawings.

10.10.4 Modification Drawings. Modifications to construction contracts are high priority items and shall be acted upon without delay. Timely preparation of contract documents to accompany the modification package will prevent undue delay in construction schedules. Upon receipt of design requirements for a proposed modification, the A-E will proceed with preparation of the necessary changes or additions. Construction Division will forward the completed package to the Project Manager for finalization and subsequent implementation. Modifications to the construction contract may be accomplished by application of one or more methods available to the A-E. Formulating a clear, concise, and accurate modification package cannot be overemphasized. A method of modifying the contract documents is to revise an existing drawing. Care should be taken to conform to the existing drafting style already present on the drawing files. Acceptable terminology which should appear in the revision block "**REVISED IN ACCORDANCE WITH MCB ##-##-**". Each modification should be properly numbered, described, dated, and initialed by the A-E firm. Occasionally a modification requires preparation of one or more new sheets because of the magnitude of the change. For sheets to be added by modification, the revision block will **not** include the revision number, and the words "**SHEET ADDED BY MODIFICATION #**" will be entered under "Description". Care should be exercised in assigning Sheet IDs to new drawings. For example, if a new sheet is to be inserted between existing Sheets A-501 & A-502, the proper identification would be Sheet A-501A. All drawings added by modification should be noted on the Index of Drawings.

10.11 **SPECIFIC INSTRUCTIONS.** Exceptions to these guidelines or additional guidance relative to a specific job may be provided in the Specific Instructions to A-E for that job.

CHAPTER A-10  
DRAWINGS  
EXHIBITS

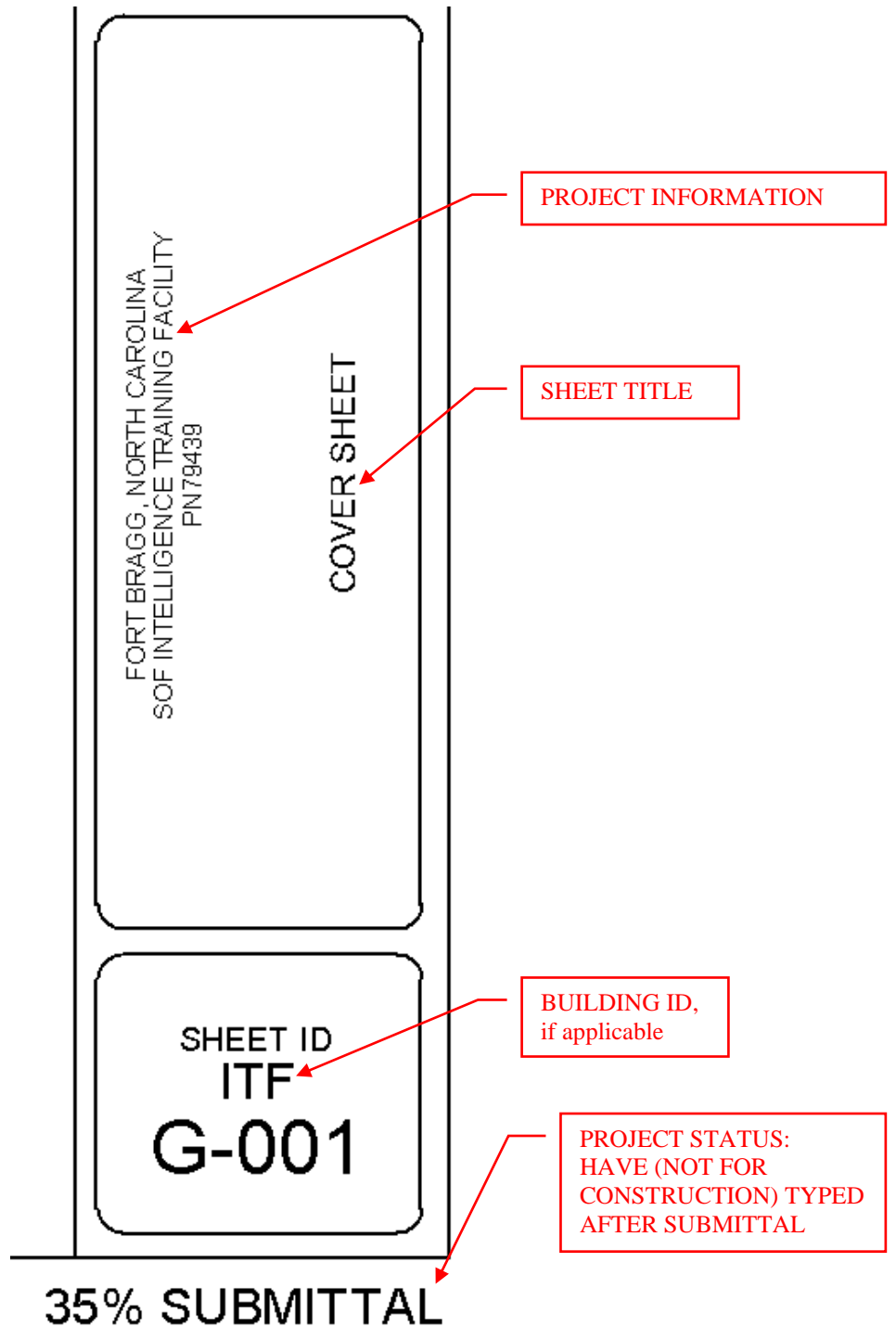


EXHIBIT A-10-1

TITLE BLOCK, SHEET IDENTIFICATION AND PROJECT INFORMATION BLOCK

U.S. ARMY CORPS OF ENGINEERS SAVANNAH DISTRICT 100 W. OGLETHORPE AVE. SAVANNAH, GA 31401		DESIGN BY:	ISSUE DATE:
		J. DESIGNER	MAY 2015
		DRAWN BY:	SOLICITATION NO.:
		J. DRAWER	XXXXX-XX-X-XXXX
		CHECKED BY:	CONTRACT NO.:
		J. CHECKER	XXXXX-XX-X-XXXX
		SUBMITTED BY:	CATEGORY CODE:
		J. SUBMITTER	171-19-04
		SIZE:	FILE NAME:
		ANSI D	FY16PN79439 G-001.dgn

MISC  
PROJECT  
INFORMATION

OWNER  
INFORMATION

CONTRACTOR  
INFO AREA

EXHIBIT A-10-2  
A-E TITLE BLOCK, MANAGEMENT BLOCK



2	REVISED IN ACCORDANCE WITH AMENDMENT 0005	10 APR 2015	
1	REVISED IN ACCORDANCE WITH AMENDMENT 0002	02 APR 2015	
<b>MARK</b>	<b>DESCRIPTION</b>	<b>DATE</b>	

EXHIBIT A-10-3  
SAMPLE REVISION BLOCK









## CHECKLIST FOR FINAL SUBMITTAL DRAWINGS

The checklist is designed to acquaint firms with printing and storage requirements for preparation of contract documents. It is intended to serve only as a guide and does not replace detailed criteria provided elsewhere.

- \_\_1. All work depicted on drawings should be suitable for reproduction to one-half size.
- \_\_2. A minimum of 1/8" height text should be used within the body of the drawing.
- \_\_3. All **new** work should be shown three weights heavier than existing work when both new and existing appear on the same drawing.
- \_\_4. Plans and model files should be checked for duplications or overprinting of features, notes, plans, sections, details.
- \_\_5. Titles, subtitles, title block and revision block information should be in accordance with Section A-10, Savannah District Design Manual for Military Construction.
- \_\_6. Titles of drawings should agree with the titles listed on the Index of Drawings.
- \_\_7. Signature blocks used to be required on the first set of each discipline, but with electronic bid sets signature blocks are not required.
- \_\_8. Site-adapted drawings must have the appropriate notation in each revision block.
- \_\_9. Amended or modified drawings must have the appropriate notation in each revision block, with triangle on the sheet where the change was made. Triangle is to have the revision number inside.
- \_\_10. Symboling on drawings should be in accordance with A/E/C CAD Standards.
- \_\_11. Coordinate the use of cross-referencing bubbles for locating sections, details and elevations.
- \_\_12. On the Final Design submittal, all title block numbering, (SHEET ID, Category Code, Solicitation No.) should be in place.
- \_\_13. All final contract drawings should have the design file name on the electronic title block.
- \_\_14. Colored ink should not be used for plotting.
- \_\_15. When a plan is cut into multiple sheets to provide a larger scale, provide a key plan showing where the individual plan is in relation to the overall site.
- \_\_16. All drawings should be the same size when plotted at full size. (22" x 34" for English jobs)  
(594 x 842 mm for Metric jobs)
- \_\_17. No specialized pen table or plot tables should be used to depict line styles or symboling.
- \_\_18. All drawing files must be present on the final CD and the CD should be marked either by label or pen with **Base Name, Project Name, FY, Line Item, CAD#, Submittal Phase and Firm Name**.

- \_\_\_19. All PDF files numbered by sheet number shall be submitted. Make sure that all PDF files have SHEED IDs, solicitation numbers, category codes and dates prior to corrected final submittal. Project Manager will provide the solicitation number.
  
- \_\_\_20. Provide an excel spreadsheet or text file with PDF filename, SHEET ID and drawing title with the corrected final submittal.

EXHIBIT A-10-8  
CHECKLIST FOR FINAL SUBMITTAL DRAWINGS

TYPICAL DRAWING SET BY DISCIPLINE DESIGNATOR	
DISCIPLINE	DESIGNATOR
GENERAL	G
HAZARDOUS MATERIALS	H
SURVEY/MAPPING	V
GEOTECHNICAL	B
CIVIL	C
LANDSCAPE	L
STRUCTURAL	S
ARCHITECTURAL	A
INTERIORS	I
EQUIPMENT	Q
FIRE PROTECTION	F
PLUMBING	P
PROCESS	D
MECHANICAL	M
ELECTRICAL	E
DISTRIBUTED ENERGY	W
TELECOMMUNICATIONS	T
RESOURCE	R
OTHER DISCIPLINES	X
CONTRACTOR/SHOP DRAWINGS	Z
OPERATIONS	O

**NOTE:**  
**THIS IS GUIDANCE FOR SEQUENCING**  
**OF DRAWINGS FOR LARGE PROJECTS.**  
**IT IS UNDERSTOOD THAT SOME OF**  
**THE CATEGORIES LISTED MAY NOT**  
**BE APPLICABLE TO ALL PROJECTS.**

EXHIBIT A-10-9  
TYPICAL DRAWING SET

\*\*\* End of Section \*\*\*



**CHAPTER A-11**  
**SPECIFICATIONS**

**Revised July 2020**

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## CHAPTER A-11

### SPECIFICATIONS

11.1 **GENERAL.** The Engineering Data Management Section (EN-DD) coordinates the activities related to the preparation and issuance of the bid document for formally advertised projects. The section assists the A-E with the format and administrative requirements involved with preparing the contract specifications and reviews these specifications for continuity of bid documents.

This chapter has been prepared to assist the A-E in preparing the contract specifications. Questions relating to this chapter or any facet of specification writing or preparation shall be directed to the Savannah District Project Manager. EN-DD will promptly respond to the Project Manager's inquiry.

#### 11.2 **APPLICABLE PUBLICATIONS.**

ER 1110-345-100 Design Policy for Military Construction

ER 1110-1-8155 Specifications

ER 415-1-10 Contractor Submittal Procedures

Federal Acquisition Requirements

Part 6, Competitive Requirements

Part 7, Acquisition Planning

Part 10, Specification, Standards and Other Purchase Descriptions

Part 36, Construction and Architect-Engineer Contracts

UFC 1-300-02 UFGS Format Standard

11.3 **PRECONCEPT SUBMITTAL REQUIREMENTS.** No requirements.

11.4 **CODE 3 DESIGN SUBMITTAL REQUIREMENTS.** Submittal content and format shall be as described in applicable year Project Definition Report (PDR) instructions (obtained from SAS PM).

11.5 **CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS.** The A-E shall submit a listing of the proposed guide specifications and A-E prepared sections that will be required for the project. The proposed table of contents shall show sections using the current UFGS numbers and titles. Sections shall be arranged within their respective divisions, in numerical order. New specification sections developed by the A-E shall be numbered in accordance with the Construction Specification institute's (CSI's) current MasterFormat, given a 5th level designation of 99, and the A-E Firm's name shall be placed in the Section header as the Preparing Activity.

#### 11.6 **PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS**

Division 01 specifications submitted at this stage should be complete, with no issues appearing on the SpecsIntact reports. Although the technical specifications (Divisions 02 - 48)

submitted at this stage are not required to be completely edited, there should be no issues appearing on the Section Verification and Address Verification reports.

#### **11.7 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS.**

The A-E shall provide an electronic copy of the final project specifications in SpecsIntact format, on CD. The original technical sections shall have been prepared in accordance with the specific requirements and instructions contained in this chapter.

#### **11.8 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.**

11.8.1 Notice. In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

11.8.2 Corrected Submittal. When this submittal stage is required, the A-E shall submit the final project specification that has been corrected and/or revised in accordance with the Final Design Submittal review comments. The submittal shall include the A-E's annotated comments (see paragraph 11.14) indicating the action taken on each of the review comments.

**11.9 REQUIREMENTS FOR DESIGN/BUILD RFP PACKAGES.** The requirements of D/B RFP package are basically the same as for Final Design above and as further described by specific instructions to contract or delivery order. The format of the D/B package will be different in that typically very few technical specifications are included. The requirements are more performance oriented.

11.9.1 RFP Wizard. For some projects RFP development will require the use of an Internet based tool called the "RFP Wizard".

11.9.1.2 Access to the Internet web site is controlled by User Name and Password. The site is: [https://ff.cecer.army.mil/rfp\\_wizard/](https://ff.cecer.army.mil/rfp_wizard/). The Project Manager can sponsor an A-E firm's point of contact (POC) to be added into the system, by submitting a formal request to SAS administrator. (The following information is needed: POC First Name, MI, Last Name, e-mail address and Firm's Name). A User Account will be set up for one member of the firm with Power User rights. This permits the A-E to create new jobs in the system, input data, and assign other to the project. When new jobs are set up, the A-E shall also assign the SAS Administrator or Specification specialist to the project so that we may do the final processing of the project once it is ready to advertise. Power User can only manage projects they "Own". After the corrected final is submittal, ownership of the Project will be transferred to the SAS Administrator in SAS-EN-DGO.

11.9.1.3 Specifics of using the RFP Wizard are covered in chapter 7 of the MILCON Implementation Guide which is available for downloading at the introductory Welcome page of the Wizard shown above. (No login is needed)

11.9.1.4 Create a New Project using the same name as provided on the 1391, with the addition of the building type in the task order name, if multiple RFP packages are required. Once a project name is set up, a series of windows appear asking questions of the project and

acquisition strategy. If the District has not selected an acquisition strategy or the Project Manager has failed to inform the A-E, choose C-Type contract initially. This can be changed later, and will not affect the technical requirements of the RFP.

11.9.1.5 With Power User rights this permits the A-E to assign other design team users to projects. Typically a representative of each discipline responsible for the RFP creation. The A-E may however elect to have only one person input the data.

11.9.1.6 Once all data is filled in, the Wizard can create a draft RFP with all administrative and technical sections necessary for a basic RFP. For Draft submittals Section 00 21 00 through 00 73 00 should be generated with the submittal as well as the technical and other Division 1 sections. Sections 00 21 00 through 00 73 00 may not be used in the format provided for the advertisement because SPS (PD2) system is mandated by DoD and is not compatible with Wizard output.

11.9.1.7 Chapter 7 of the Implementation guide shows all the windows that will need input for a new project. It is recommended that these lists be reviewed at pre-design meetings to attain as much information as possible.

11.9.1.8 Appendices. By default, the wizard will add cover sheets for some appendices. Appendix K and L have standard content provided by the MT Team. Other appendices will be considered “not used” unless replaced by the preparer as follows: Select the Radio Button next to the appendix you wish to upload and then select the “Browse” button to locate the file on the local machine. Once selected, click the “Upload” button in the middle of the page to attach the file. This action will replace the “Not Used” version of the appendix with the project specific content. Contact the Project Manager to see if the District has some standard appendices for an Installation. The A-E or Savannah District will provide the Geotechnical Information Appendix A, depending on contract agreement.

11.9.1.9 If the project includes more than one task order at the same site, a few other User Defined appendices are required. These are Appendix N, LEED Requirements for Multiple Contract Combined Projects, Appendix O, LEED Strategy Tables and Appendix W, Demarcation Matrix is generally required. This appendix would naturally be very project specific and must be provided by the A-E.

11.9.1.10 Download the file from “View the Draft RFP”. Generate the file and download it for faster viewing. Do not LOCK the RFP. This will only be done when a solicitation / task order number has been assigned and we have authority to advertise. Generally this is only done by the District.

## **11.10 TYPES OF SPECIFICATIONS FOR FULL DESIGN.**

11.10.1 Available Guide Specifications. Project specifications shall be prepared using the Unified Facility Guide Specifications (UFGS) obtained from the Whole Building Design Guide ([WBDG](#)), furnished by the Savannah District, or as prepared by the A-E for job specific requirements when not available elsewhere, and using the SpecsIntact software, available from [NASA](#). The guide specifications shall be edited and adapted by the designer to fit each individual project in accordance with the project requirements. The designer shall delete the inapplicable portions of the guide specifications and revise and/or supplement, as required, the applicable portions to provide a complete project specification. Deviations, except as authorized by ER 1110-1-8155, will not be allowed without prior approval through the Savannah District.

UFGS that have been unified for use by all participating agencies have a level 3 (## ## ##) or level 4 (## ## ##.##) Master Format<sup>(TM)</sup> number. UFGS that are agency-specific have a fifth level number (## ## ##.## ##). A fifth level number "10" indicates USACE, "20" indicates NAVFAC, "30" indicates AFCESA, and "40" indicates NASA. Specification Sections prepared by Savannah District have the 5th level number "37". Preparing agencies are indicated in the UFGS header of each specification. When selecting Specification Sections, the A-E should follow this order of preference:

- (A) Savannah District Guide Specifications, available through the PM
- (B) USACE-specific UFGS (or AFCESA-specific, for USAF projects)
- (C) unified UFGS
- (D) UFGS identified as specific to another agency

In SpecsIntact, after adding the necessary Specification Sections to a project and before editing individual Sections, globally review and delete inapplicable Tailoring Options.

NOTE: All specifications shall be written in accordance with the requirements of the technical manuals and the architectural and engineering instructions and as required by law to provide open and competitive bidding without proprietary exclusion of acceptable products. The guide specifications, including the "Notes To The Specifier," shall be reviewed before starting the drawings and again before writing the specifications. See ER 1110-1-8155 for criteria, guidance, and limitations not covered by these standard procedures.

11.10.2 Other Specifications. When there is no appropriate UFGS for a particular topic, the A-E will prepare the required specification. The specification shall be prepared using a SpecsIntact template and the UFGS format. The specification shall not be written around materials, equipment, or procedures which restrict competitive bidding unless a specific waiver has been obtained by the Project Manager. The A-E shall prepare the required section using one of the following procedures:

11.10.2.1 Functional or Descriptive Specifications. The A-E will normally be instructed to prepare "functional or descriptive specifications" using industry standards, manufacturer's data, and other available information. These specifications shall be prepared and developed by listing parameters, methods, techniques and other requirements that several manufacturers can satisfy. These specifications shall list the essential features, requirements, minimum functions, and other factors to clearly indicate the type and quality of item required. Specifications should not be developed around a single manufacturer. Questions concerning the preparation of specifications of this type should be directed to the Project Manager.

11.10.2.2 Sole Source Specifications. There may be instances when only one manufacturer's product will satisfy job conditions. For example, in rehabilitation work, updating a particular piece of existing mechanical equipment may require new parts from the manufacturer of that particular piece of equipment. A sole source type may be acceptable in this instance, provided prior approval is received from higher authority. To receive approval, the A-E must provide written sole source justification to the Project Manager. This justification should be prepared and presented as early in the design process as possible, since approval usually takes considerable time. The A-E should be aware that preparing proprietary type specifications based on trade, brand, manufacturer's name or adopting a manufacturer's description of a particular article or procedure is unacceptable and shall be avoided.

11.10.2.3 "Or Approved Equal" Specifications. In some instances, acceptable standards of quality may be listed by brand name or approved equal. The salient features of the product, the names of at least 3 manufacturers (with current addresses and phone numbers) and model numbers must be listed. Each of the listed items should be items exhibiting the functional characteristics required. Each brand name should be followed by the words "or approved equal." The intent of the "or approved equal" procedure is to offer bidders the opportunity to substitute items equal in functionality and quality. "Or approved equal" specifications should be avoided, in preference to "functional or descriptive specifications".

11.11 **SPECIFICATION PREPARATION METHOD.** For full designs, Savannah District accepts only specifications prepared in SPECSINTACT format. Use the most current version of the sections at the time final design documents are being developed.

11.11.1 SPECSINTACT. SpecsIntact software is available, free of charge, from the NASA-maintained website <http://specsintact.ksc.nasa.gov/Software/Software.shtml>

11.11.2 Using SPECSINTACT. Refer to SPECSINTACT User Manual. A-E is responsible for obtaining their own training on this software.

11.11.3 Developing Unique Project Specifications. The software will permit the generation of a new section for a specific item, material, or process. Use the generic template to create a unique specification. When sole source requirements have been Government-approved and are included in the specifications, for each such requirement the designer will develop the items described at FAR 6.303-2. Create unique specifications following the Construction Specifications Institute (CSI) guidelines as modified by UFC 1-300-02. When the A-E is required to prepare a specification section for a unique product or procedure, the section shall be prepared using SPECSINTACT.

11.12 **ADMINISTRATIVE SPECIFICATION SECTIONS.** In addition to all technical sections, all final design and final RFP submittals will include all administrative sections. Coordinate with PM on development of administrative sections, which involve Contracting, Construction, Engineering and Project Management Division coordination. See Exhibit A-11-7 for a listing and description of typical administrative sections. Editing specifications and incorporation of review comments for all administrative sections will be coordinated by the PM and may vary on a project by project basis. Provide the following items to the Project Manager prior to the final design/final RFP submittal for internal coordination of administrative sections.

11.12.1 Scope of Work. The A-E shall submit Section 01 11 00 SUMMARY OF WORK. The scope of work will be a brief written description of the work involved and will include a listing of approximate quantities, such as "the work includes the construction of a 250,000 square foot administrative building...." The project site shall be located by including the name of the Installation, county, and state in which the work is done. Also, the appropriate cost range shall be selected by the A-E from the ranges listed below and included at the end of the resume:

- less than \$25,000
- between \$25,000 and \$100,000
- between \$100,000 and \$250,000
- between \$250,000 and \$500,000
- between \$500,000 and \$1,000,000
- between \$1,000,000 and \$5,000,000
- between \$5,000,000 and \$10,000,000

between \$10,000,000 and \$25,000,000  
between \$25,000,000 and \$50,000,000  
between \$50,000,000 and \$100,000,000  
over \$100,000,000

See Exhibit A-11-5.

11.12.2 Construction Time Estimate. The A-E shall submit a Construction Time Estimate and the rationale used to develop the estimate. When preparing the estimate, consideration shall be given to procurement of materials, sequence of construction, climatic conditions to be encountered during construction, etc.

11.12.3 Bid Schedule (Section 00010). The A-E shall submit a proposed Bid Schedule for bidding purposes. The Schedule shall set up all lump sum and unit price items for the work to be accomplished under the contract. Lump Sum items are generally preferred for Military projects. Break out major items such as site development and individual building types. On renovation projects, it may be best to break out individual tasks even further so that they can be used for comparison during negotiations. Occasionally unit price schedule is more suitable. Ensure that unit price schedule is in agreement with payment paragraphs of technical specifications and is prepared in accordance with instructions contained in Chapter A-9 Cost Estimates. The bid schedule shall be carefully coordinated with the payment paragraphs (if required) included in the technical specifications. In instances where extremely small quantities are involved in the exterior items of work, payment will be on a "job lump sum basis" (see Exhibit A-11-2). When large quantities are involved in exterior items of work, payment will be made on a "unit price basis" (see Exhibit A-11-3). A list of quantities for each item of outside work--site preparation, drainage, paving and utilities--will be submitted with the quantity takeoff regardless of whether the item is paid for on a lump sum or unit price basis (see Exhibit A-11-4).

11.12.4 Table of Contents. The A-E shall prepare and submit a Table of Contents for the specifications.

11.12.5 List of Government-Furnished Equipment. If applicable, the A-E shall submit a list of Government-furnished equipment, including the description, weight, size, quantities, and approximate value for inclusion in the contract clauses of the solicitation. This list is usually applicable in renovation or relocation projects when the user wishes to relocate existing equipment. This list shall be furnished in two categories, Government-Furnished, Contractor-Installed (GFCI) and Government-Furnished, Government-Installed (GFGI), if applicable.

11.12.6 Salvable Material. If applicable, the A-E shall submit information concerning any salvable material.

11.12.7 Special Situations. The A-E shall submit information covering any unusual situations, i.e., interface problems, outages, security and/or safety requirements, storage areas, construction sequences and phasing requirements, access to site, early completion dates, etc.

11.12.8 Construction Phasing. For complex projects that include demolition before new construction can begin require a phasing plan. The A-E will provide phasing requirements for construction as part of the scope of work and technical requirements.



11.12.9 Additional Submittals. The complexity of some projects may require additional submittals, other than those previously listed. The A-E shall be advised of any additional submittal requirements and shall submit them as directed.

11.12.10 Questions. Any questions concerning the above listed submittal requirements should be directed to the Project Manager.

11.13 **Technical Specifications.** The technical specifications shall include performance and specific tasks type specifications for all work required to complete the project.

11.13.1 Responsibility. The A-E shall be responsible for the accurate preparation of the technical specifications. The A-E shall provide clarification, corrections for amendments or revisions needed to correct errors or omissions.

11.13.2 Editing. The A-E will delay preparation of the project specifications until after the preliminary review stage. Generally, guide specifications must be edited by the A-E to satisfy the requirements of the particular project being designed. Use the "Revisions" option in the SpecsIntact software (similar to "Track Changes" in MS Word) to track additions, changes, and deletions within the Sections. The drawings and specifications must complement each other. All extraneous and irrelevant information contained in the guide specifications must be eliminated. Likewise, information not originally contained in the guide specifications must be added to ensure a complete specification. Furthermore, functional or descriptive specifications must be developed as necessary to fully specify the requirements of the project being designed.

11.13.3 Notes to the Specifier. Specific "NOTES TO THE SPECIFIER" are included in the body of guide specifications. These notes are denoted by a row of asterisks above and below the notes. These notes form an important part of Corps of Engineers technical requirements and offer direction to the specification writer. They should be carefully followed not only in preparing the specification but particularly in preparation of drawings. In many instances, reference is made to items not included in the main body of the specification. The A-E shall read the notes and comply with the instructions contained therein. It is very important to provide drawing details referenced in the specification.

11.13.4 Contractor Submittals. The specifications shall require the Contractor to submit shop drawings, samples, manufacturer's data, certificates, test reports, etc. as appropriate. Each individual submittal needs to be coded as to the review level in accordance with the "NOTES TO THE SPECIFIER" for the Paragraph SUBMITTALS in each specification Section. Generally, it is desirable that the requirements for government approval of submittals be kept to a minimum pursuant to this ER. Generally, only submittals requiring significant extensions of a design, designer oversight of complex systems or commissioning requirements will be listed as requiring Government approval (G). In most cases, the submittals are for Information Only. But there are "G" level reviews. Here a decision has to be made: if this is an extension of design, then the "Designer of Record" needs to review it, otherwise the Government Area or Resident office will review it. Once each submittal is properly coded, the software can generate ENG Form 4288 automatically.

For an A-E prepared specification section, the A-E shall properly code the SPECSINTACT document so that submittals will be included in ENG Form 4288.

11.13.5 Payment Paragraphs. No payment paragraphs will be required when bid items on the Schedule are all job, lump sum. Payment paragraphs are required for those sections which cover miscellaneous utilities, roadways, site development, and other outside facilities set up for

separate payment at a unit price. Each section of specifications which sets items of work for separate payment shall have a paragraph entitled "PAYMENT." This paragraph shall be so worded as to conclusively indicate the method of payment and shall be fully coordinated with the applicable item listed in the Schedule.

11.13.6 Deleted Paragraphs. When editing a guide specification in preparing the final project specifications, the A-E shall delete inapplicable paragraphs entirely, including the SpecsIntact "tags".

11.13.7 Attachments and Appendices. When other files, such as checklists, reports, or spreadsheets, must be included with the specifications, the files may follow an individual Section or be added to the end of the specifications. Submit the files, in Adobe pdf format, with the SpecsIntact files for the design submittals. The A-E may also send the files in their original format.

11.13.7.1 Attachments. Small files, such as a LEED Project Checklist or hardware schedule, may follow the appropriate Section; these files shall be referred to in the Section as an attachment ("See Attachment A 'Hardware Sets'") and the file itself shall be named with the Section number and the attachment letter (e.g., 08 71 00a.pdf). The letter designations shall be consecutive within each Section and restart again for new Sections (e.g., 01 33 29a.pdf, 01 33 29b.pdf, 08 71 00a.pdf)

11.13.7.2 Appendices. Larger files, such as asbestos surveys or geotechnical reports, shall be placed at the end of the specifications and referred to as appendices ("See Appendix A 'Bldg 386 Hazardous Materials Survey'"). File names shall be descriptive and start with the Appendix letter (e.g., "A - Geotech Rpt.pdf", "B - ACM Survey"). The Savannah District standard Appendix cover sheet will be available from the PM.

11.13.8 SPECSINTACT Verification Reports. Process the Section files in SpecsIntact and appropriately resolve the issues in the reports (address verification, bracket verification, reference verification, section verification, submittal verification, and reference title).

11.14 **Quality of Work.** In accordance with the "Responsibility of the Architect-Engineer" clause of the Contract Clauses of the Architect-Engineer contract, the A-E is totally responsible for the content of the technical specifications and for material shown on the drawings which has been inadvertently omitted from the specifications. The specifications shall be clear, concise, complete, correct, and shall not be subject to interpretation. They shall be specific and free of ambiguities.

11.14.1 Coordination. The A-E shall coordinate the specifications with the drawings and cross check all references within the specification for agreement with the drawings and other sections of the specifications.

11.14.2 Checklist. A checklist for final specification preparation is included as Exhibit A-11-1 and should be used to ensure that specifications are acceptable. If any of the questions are answered "NO," that portion of the work is unacceptable. Any questions resulting from answering the checklist should be referred to the Project Manager.

11.15 **PROJECT REVIEW COMMENTS.** The A-E shall annotate the action taken on each concept/preliminary, final or corrected final review comment and shall include the annotated comments with the appropriate submittal package. If the A-E feels that any comment is

inappropriate or in error, he shall contact the Project Manager to resolve the conflict. If the comment is modified or omitted as a result of this coordination, then a brief record of the conversation shall be included with the annotated comments.

#### **11.16 CONTRACT PLANS AND SPECIFICATIONS.**

11.16.1 Handling Bidder Inquiries. Drawings and specifications are furnished to the A-E's for those projects they have designed at the same time they are furnished to bidders. Questions from contractors or suppliers to the A-E requiring interpretation should be referred to the Savannah District. An example of this reasoning would be an occurrence wherein a supplier queried an A-E as to whether a certain insulation would meet requirements of the specifications. He reputedly was told that it would, and based his bid accordingly. Criteria requirements had been changed subsequent to design completion by the A-E. The Savannah District had changed the specifications to conform to the new criteria. The insulation proposed would not meet the new requirements.

11.16.2 Clarification Inquiries. The above guidance is not intended to discourage A-E's from following through on requests for clarification, etc., received from bidders. In many cases, such requests require clarification or correction. In such cases, the A-E should notify the Project Manager in the Savannah District by the most expeditious means of communication available of the nature of the discrepancy and the A-E's recommendations for correction. This action permits correction by amendment to the solicitation rather than by a more expensive contract modification.

11.17 **AMENDMENTS.** During the advertisement period as discrepancies, oversights, omissions, and other changes surface, the A-E shall prepare affected drawings and specifications for amendment. All questions involving the amendment procedure should be addressed to the Project Manager. Federal regulations require that bidders be given ample time for the necessary assimilation of the materials contained in the amendment, and that the material is received at least 14 days prior to bid opening date. When required, the A-E will furnish to Savannah District, no later than 3 weeks prior to date of bid opening, a CD reflecting revised specifications and drawings incorporating all amendment changes.

11.17.1 Amended Specifications. The A-E is required to furnish revised sections electronically showing the changes made by amendment. To show only the changes made by amendment, accept the changes made during the design process before revising the Section using the "Revisions" option. Each revision will be indicated by placing an asterisk and the amendment number (e.g. \*1, \*2, etc.) in the nearest blank line above the revised text. Each revised or added section will carry the statement "(Revised [or Added] by Amendment No. 000\_)", right-justified, in the footer of each page.

11.17.2 Deleted Paragraphs. In preparing the original specifications, deleted paragraphs and subparagraphs were removed entirely. In revising the specifications by amendments, the paragraphs being removed are re-titled as "Deleted."

11.18 **MODIFICATIONS.** Modifications to construction contracts are high priority items and shall be acted upon without delay. Timely preparation of contract documents (see Exhibit A-11-7) to accompany the modification package will prevent undue delay in construction schedules. Upon receipt of design requirements for a proposed modification, the A-E will proceed with preparation of the necessary changes or additions. The completed package will be forwarded to the Project Manager for finalization and subsequent implementation by Construction Division.

Modifications to the construction contract may be accomplished by application of one or more methods available to the A-E. Formulating a clear, concise, and accurate modification package cannot be overemphasized.

11.18.1 Scope of Work. One of the most important items the A-E must furnish for a modification is a clear concise scope of work for all major aspects of the modification.

11.18.2 Specifications. When revisions or additions to the specifications are necessary, each change will be indicated by placing a hashtag and the modification number (e.g. #1, #2, etc.) in the nearest blank line above the revised text, using the "Revisions" option. Each revised or added section will carry the statement "(Revised [or Added] by Modification No. 000\_)", right-justified, in the footer of each page.

11.18.3 Modification Drawings or Sketches. Refer to Chapter A-10 for discussion of modifying contract drawings.

11.18.4 Modification Estimate. Cost estimates should be prepared in detail as required for final design documents as described in Chapter A-9, COST ESTIMATES, of this manual. The cost estimate must accompany the finished modification package.

## CHECKLIST FOR FINAL SPECIFICATION PREPARATION

	YES	NO
a. Have all "gaps" been eliminated where material has been omitted from text?	_____	_____
b. Have verification reports been run and errors corrected in an appropriate manner?	_____	_____
c. Has ENG Form 4288 SUBMITTAL REGISTER been printed?	_____	_____
d. Have attachments and appendices been included in the submittal?	_____	_____

SAMPLE BIDDING SCHEDULE SUGGESTED FOR SMALL PROJECTS AND PROJECTS  
WITH MINOR SITE WORK AND UTILITIES

Section 00010 - Solicitation Contract Form

MUNITION STORAGE FACILITY  
POPE AIR FORCE BASE, NORTH CAROLINA

ITEM	DESCRIPTION	QUANTITY	U/M	U/P	AMOUNT
0001	BASE BID - Construction of Storage Igloos (1 and 2) to the 5-Foot Building Line, Complete	1	LS	XXX	_____
0002	BASE BID - Site Preparation and Development, Including Utilities, Complete	1	LS	XXX	_____
0003	ADDITIVE NO. I - Construction of Flammable Storage Building to the 5-Foot Line, Complete	1	LS	XXX	_____
TOTAL BASE BID (ITEMS 0001 AND 0002)					\$ _____
TOTAL BASE BID PLUS ADDITIVE NO. I (ITEMS 1 THROUGH 3)					\$ _____

END OF SECTION 00010

SAMPLE BIDDING SCHEDULE SUGGESTED FOR LARGER PROJECTS

Section 00010 - Solicitation Contract Form

PAVING OF EXISTING ROADS AND PARKING AREAS  
CLARKS HILL DAM AND LAKE  
SAVANNAH RIVER  
GEORGIA AND SOUTH CAROLINA

ITEM	DESCRIPTION	QUANTITY	U/M	U/P	AMOUNT
0001	Paving of Existing Roads and Parking Areas - Petersburg Recreation Area:				
0001A	1-1/2 Inch Thick Bituminous Course	13,000	SY	_____	_____
0001B	6-Inch Thick Graded Crushed Aggregate Base Course	13,000	SY	_____	_____
0001C	Lower Subgrade 6 Inches	6,240	SY	_____	_____
0002	Paving of Existing Roads and Parking Areas - Winfield Recreation Area:				
0002A	Bituminous Pavement Leveling	17,920	SY	_____	_____
0002B	1-1/2 Inch Thick Bituminous Pavement Overlay	17,920	SY	_____	_____
0002C	1-1/2 Inch Thick Bituminous Pavement on Completed Base Course	1,680	SY	_____	_____
0002D	6-Inch Thick Graded Crushed Aggregate Base Course	6,240	SY	_____	_____
0002E	Remove and Repair Existing Pavement	1	LS	XXXXX	_____
TOTAL BID (ITEMS 0001 THROUGH 0002E)					\$ _____

END OF SECTION 00010

SAMPLE BIDDING SCHEDULE SUGGESTED FOR LARGER PROJECTS WITH MULTIPLE  
ADDITIVES

SECTION B  
SUPPLIES OR SERVICES AND PRICES/COSTS

GENERAL INSTRUCTION FACILITIES &  
MARION AVENUE WIDENING  
FORT JACKSON, SOUTH CAROLINA

ITEM	DESCRIPTION	QUANTITY	U/M	U/P	AMOUNT
0001	BASE BID - General Instruction Facility with Metal Roof, Complete to the 5-Foot Building Line	1	LS	XXX	_____
0002	BASE BID - Site Preparation and Development Utilities and Parking Lots for the General Instruction Facility, Complete	1	LS	XXX	_____
0003	BASE BID - Marion Avenue Widening Including Landscaping and Utilities, Complete	1	LS	XXX	_____
0004	BASE BID - Install Government-Furnished Interior Furnishings, Complete	1	LS	XXX	_____
0005	ADDITIVE NO. I - Changing Room, Complete	1	LS	XXX	_____
0006	ADDITIVE NO. II - Auditorium Roof Deck, Complete	1	LS	XXX	_____
0007	ADDITIVE NO. III - Sodding, Complete	1	LS	XXX	_____
TOTAL BASE BID - ITEMS 0001 THROUGH 0004					\$ _____
TOTAL BASE BID PLUS ADDITIVE NO. 0001 ITEMS 0001 THROUGH 0005					\$ _____
TOTAL BASE BID PLUS ADDITIVES NOS. 0001 AND 0002 ITEMS 0001 THROUGH 0006					\$ _____
TOTAL BASE BID PLUS ADDITIVES NOS. 0001 THROUGH 0003 ITEMS 0001 THROUGH 0007					\$ _____

END OF SECTION 00010



## SCOPE OF WORK

The site of work is located in Houston County, Georgia, at Robins Air Force Base and includes the following principal features and approximate quantities:

- (a) Construction of a gymnasium containing approximately 10,000 square feet of floor space, consisting of concrete floor slabs, concrete frame, concrete masonry unit walls, open web steel joists, steel deck and built-up roofing. Interior work includes plumbing, heating, air conditioning, and electrical work. Gymnasium to be furnished with miscellaneous gymnasium equipment.
- (b) Gas line - 500 feet of 1-1/2 inch pipe.
- (c) Water line - 400 feet of 3-inch pipe; 3-inch gate valve; connection to existing 10-inch line.
- (d) Sanitary sewer - 285 feet of 6-inch pipe; 1 manhole.
- (e) Sprigging - 1.6 acres.
- (f) Landscaping for the gymnasium building.
- (g) Exterior electrical work.
- (h) Clearing and grubbing, including removal of portable wooden bleachers (16' x 74') - 2.9 acres.
- (i) Unclassified excavation - 1,500 cubic yards.
- (j) Unclassified borrow - 500 cubic yards.
- (k) 1-1/2 inch flexible pavement, including tack and prime coats and 7-1/2 inch stabilized aggregate base course - 700 square feet.
- (l) 4-inch concrete sidewalk - 500 square yards.
- (m) 6-inch asphalt concrete curb - 50 linear feet.
- (n) Precast concrete bumper curbs - 13 each.
- (o) 4-inch printed stripes - 150 linear feet.
- (p) Storm drainage system:

6-inch pipe	72 linear feet
8-inch pipe	202 linear feet
10-inch pipe	58 linear feet

The cost of this work is estimated to be between \$1,000,000 and \$5,000,000. Construction duration for this project is estimated to be 360 days.

EXAMPLE MODIFICATION SCOPE OF WORK

Modification of Specifications  
Solicitation Number DACA21-95-B-0110  
Contract No. DACA21-96-C-0029  
Modificaton No. MCB96-29-D

U.S. ARMY ENGINEER DISTRICT, SAVANNAH  
CORPS OF ENGINEERS  
100 WEST OGLETHORPE AVENUE  
SAVANNAH, GEORGIA 31402-0889  
10/23/95

The Specifications and Drawings for Construction of EM Barracks Complex - Fort Gordon, Georgia, under Contract Number DACA21-95-C-0029, are modified as follows:

A. SPECIFICATIONS:

The new and revised pages listed below (Revised and Added by Modification 96-29-D are hereby added to and made a part of the Contract Specifications. An asterisk in the right margin of revised pages indicates each line in which a revision was made.

<u>Section</u>	<u>Revised Pages</u>	<u>Added Pages</u>
08700		1a
09510	2	

B. DRAWINGS File No. 71-08-09:

Sheet 53 with Revision No. 1 and new Sheets 53A, 53B, 53C and 53D (Added by MCB 96-29-D) all dated 23 October 1995 are hereby added to and made a part of the contract drawings.

Encls  
Specs (2 pages)  
Dwgs as listed in Para B above  
(Revised and Added by MCB 96-29-D)

## CONTRACTUAL REQUIREMENTS

The list below contains the most commonly required Division 00 Specifications for Savannah District projects and information on coordination. These sections will be coordinated through the PM and included in all final design and final RFP submittals.

### 00 21 00 INSTRUCTIONS TO OFFERORS

Prepared by Contracting based on input from PM and A-E and provided to A-E for inclusion in submittal by PM.

### 00110 PHASE 1 of 2 DESIGN-BUILD SELECTION PROCEDURES AND BASIS OF AWARD

Prepared by Contracting based on input from PM That Has Been Coordinated with the PDT (RFP Preparer, EN, CD and Customer). Requires legal sufficiency review by OC. Provided to A-E for inclusion in submittal by PM.

### 00120 PHASE 2 DESIGN-BUILD SELECTION PROCEDURES AND BASIS OF AWARD

Prepared by Contracting based on input from PM That Has Been Coordinated with the PDT (RFP Preparer, EN, CD and Customer). Requires legal sufficiency review by OC. Provided to A-E for inclusion in submittal by PM.

### 00111 ONE PHASE DESIGN-BUILD SELECTION PROCEDURES AND BASIS OF AWARD

Prepared by Contracting based on input from PM That Has Been Coordinated with the PDT (RFP Preparer, EN, CD and Customer). Requires legal sufficiency review by OC. Provided to A-E for inclusion in submittal by PM.

### 00112 PRICE-PERFORMANCE TRADE-OFF SELECTION PROCEDURES AND BASIS OF AWARD

Prepared by Contracting based on input from PM That Has Been Coordinated with the PDT (RFP Preparer, EN, CD and Customer). Requires legal sufficiency review by OC. Provided to A-E for inclusion in submittal by PM.

### 00113 LOW PRICE-TECHNICAL ACCEPTABLE SELECTION PROCEDURES AND BASIS OF AWARD

Prepared by Contracting based on input from PM That Has Been Coordinated with the PDT (RFP Preparer, EN, CD and Customer). Requires legal sufficiency review by OC. Provided to A-E for inclusion in submittal by PM.

### 00 45 00 REPRESENTATIONS AND CERTIFICATIONS

Prepared by Contracting and provided to A-E for inclusion in submittal by PM.

### 00 72 00 CONTRACT CLAUSES

Prepared by Contracting and provided to A-E for inclusion in submittal by PM.

### 00 73 00 SPECIAL CONTRACT REQUIREMENTS

## CONTRACTUAL REQUIREMENTS

Prepared by Contracting based on input from PM, CD and Customer. Provided to A-E for inclusion in submittal by PM.

## ADMINISTRATIVE SECTIONS

The list below contains the most commonly required Division 01 Specifications for Savannah District projects. These sections will be coordinated through the PM and included in all final design and final RFP submittals. Other Division 01 Sections may be added as appropriate.

### 01 11 00 SUMMARY OF WORK

A description of work covered in this contract; this Section is required in all projects. Prepared by A-E.

### 01 14 00 WORK RESTRICTIONS

Requirements for work and site restrictions. Prepared by A-E.

### 01 22 00.00 10 MEASUREMENT AND PAYMENT

Lump sum schedule payment items and unit price schedule payment items. Prepared by A-E.

### 01 30 00 ADMINISTRATIVE REQUIREMENTS

General administrative paragraphs. Prepared by A-E.

### 01 32 01.00 10 PROJECT SCHEDULE

The preparation and maintenance of the project schedule for construction projects or design-build construction projects. Prepared by A-E.

### 01 33 00 SUBMITTAL PROCEDURES

Prepared by and available from Savannah District, this Section covers the general procedures regarding submittals, data normally submitted for review to establish conformance with the design concept and contract documents, called for in other Sections of the Specifications.

### 01 33 16.00 10 DESIGN AFTER AWARD

Post-award design submittal requirements for a Design-Build solicitation. Only applicable to Design-Build. Prepared by A-E.

### 01 33 29 SUSTAINABILITY REPORTING

This Section covers sustainability documentation for Guiding Principles Validation (GPV), and Third Party Certification (TPC). Prepared by A-E.

### 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS

Safety and occupational health requirements for the protection of Contractor and Government personnel, property, and resources. Required in all projects. Prepared by A-E.

### 01 42 00 SOURCES FOR REFERENCE PUBLICATIONS

Listing of organizations whose publications are referenced in other Sections of the Specifications. Required in all projects. The only editing necessary is the addition of organizations whose publications are not included in the Unified Master Reference List

## ADMINISTRATIVE SECTIONS

(UMRL), such as state DOT specs. A supplemental list, containing contact information for state and local sources, is available through the PM.

### 01 45 00.00 10 QUALITY CONTROL

Contractor Quality Control for construction projects or design-build construction projects. Required in all projects. Prepared by A-E.

### 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)

Use of RMS for contract monitoring and administration. RMS is used for all but the smallest projects, but confirm with the Project Manager that it will be used for the project. Prepared by A-E.

### 01 45 35 SPECIAL INSPECTIONS

Covers the requirements for special inspections when required by UFC 3-301-01. Applies to vertical construction. Prepared by the A-E.

### 01 50 00 TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

Temporary construction facilities, safety systems, construction traffic provisions, construction signage and controls over contractor operations required for use in all projects. Prepared by A-E.

### 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS

Environment protection during construction activities. Prepared by A-E.

### 01 57 23 TEMPORARY STORM WATER POLLUTION CONTROL

Temporary construction measures most used in complying with the Best Management Practices of the storm water pollution prevention plan as required by a NPDES Permit. Prepared by A-E.

### 01 58 00 PROJECT IDENTIFICATION

Temporary signs for project identification. The USACE requirements from this Section may be moved to Section 01 50 00, eliminating the need for this Section. Prepared by A-E.

### 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

The management of non-hazardous construction and demolition waste materials. Prepared by A-E.

### 01 78 00 CLOSEOUT SUBMITTALS

Closeout submittals including: revised project documents, warranty management, testing, adjusting and balancing, O & M manuals, and final cleaning. Prepared by A-E.

### 01 78 23 OPERATION AND MAINTENANCE DATA

## ADMINISTRATIVE SECTIONS

Operation and Maintenance (O&M) data packages, manuals and training. Use this Section in large or complex building projects; for small projects (e.g. repair, landscaping, civil works), the O&M requirements in Section 01 78 00 may be sufficient. Prepared by A-E.

### 01 78 24.00 10 FACILITY DATA REQUIREMENTS

Covers the requirements for maintenance and turnover of electronic Facility Data for use by O&M personnel and systems of record. May be used instead of Section 01 78 00. Confirm with the PM which Section is appropriate for the Customer. Prepared by A-E.

### 01 91 00.15 10 COMMISSIONING

Commissioning requirements. Prepared by A-E.

\*\*\* End of Section \*\*\*

**ASBESTOS AND OTHER HAZARDOUS MATERIALS  
(IDENTIFICATION, HANDLING AND REMOVAL)**

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## CHAPTER A-12

### ASBESTOS IDENTIFICATION AND REMOVAL

#### 12.1 GENERAL.

12.1.1 Scope. This chapter identifies the Architect-Engineer's (A-E's) responsibility for determining the existence of asbestos and other regulated hazardous building materials (HBMs) including mercury and polychlorinated biphenyl articles (PCBs), radioactive materials or biohazards, and implementing the safeguards for removal. (See Chapter A-13 for lead and lead based paint guidance.) In some cases asbestos and HBM surveys may be conducted by USACE or the installation. However all buildings in which renovation or demolition will be conducted must have both an asbestos survey and a HBM survey conducted.

12.1.2 Overview. In most cases, existing surveys whether for military construction, civil works or work for others are incomplete or obsolete. All asbestos surveys must include friable and non-friable materials whether inside the structure or on the exterior of the structure. Whenever asbestos containing material (ACM), or other HBMs are reported by the using military installation Director of Engineering and Housing (DEH), Base Civil Engineer (BCE) or is discovered by the A-E during a field visit, the A-E shall incorporate the provisions of this chapter into the design documents. Most 1391's will not address ACM or HBMs directly, but should include the cost of abatement and disposal in the total cost of demolition. Do not assume that because it is not specifically mentioned that it does not exist. Many states are requiring proof of ACM and HBM surveys before demolition permits are issued. Unless the owning agency can provide specific locations, types, quantities of asbestos, and certifications of the asbestos inspector and the analytical lab through recent (< 2 years old) survey reports the A-E shall be responsible for determining the actual existence and/or nonexistence of asbestos on all renovation, rehabilitation or demolition projects. All previous asbestos sampling and analysis must meet the state's current requirements and the requirements of this chapter. HBM surveys shall be made for each structure as these materials change frequently from incidental repairs and upgrades. Note that the only ACM that has been banned is friable asbestos. Non-friable asbestos is still being used in new building materials.

Acceptable verification of ACM and HBM includes the assumption of the hazardous compound's present by visual inspection by the A-E for fluorescent light tubes (mercury), light ballast, switches, manometer switches (mercury), smoke and fire detection and computerized alarm systems, roofing materials, and any switches and controls with a history of containing hazardous compounds. Negative ACM presence will require representative sampling of materials. HBM's may also include biological materials. Bats, pigeons, feral cats, rodents and other vermin may inhabit buildings. Insects such as wasps and bees may be present. Their presence, including nesting materials and guano are also considered hazardous materials that will need to be addressed for buildings going under renovation or demolition. The A-E shall include building history (construction and renovation dates) with survey report submittal. A-E firms that indicate an inability to determine the existence of asbestos (or other HBM's) shall inform the Savannah District in writing at the submittal of the initial fee proposal. However, in most cases subcontractors can perform this work for the A-E.

Asbestos (or other HBMs) survey may also be accomplished independently by the Savannah District for incorporation into the construction documents. Type and size of the project and the schedule of the USACE Asbestos Inspector will determine whether this can be accomplished. USACE will provide the survey reports for inclusion in the Request for Proposal or the Design

Package. Time allowing, USACE will prepare full size drawings. It will be the A-E's responsibility to ensure that borders for these full size drawings match the package they are preparing. Reports and drawing will be provided electronically.

12.1.3 Hazardous Materials. Exposure to airborne asbestos has been associated with multiple diseases including. Other regulated hazardous materials cause health problems. Heavy metals such as mercury, cadmium, chromium, and lead cause health problems that can lead to death. Many hazardous compounds are additives to existing products or systems, such as chromium to cooling systems and polychlorinated biphenol (PCBs), formaldehyde, arsenic and chloride compounds. Others are by products or deterioration products from materials stored or processes that occurred in the buildings. The Environmental Protection Agency and the Occupational Safety and Health Administration have adopted regulations requiring control procedures for exposure and disposal of materials containing these compounds. These regulations also provide guidance to ensure safe working conditions during demolition or renovation of buildings or structures.

Examples of materials which may contain or be covered by asbestos are as follows:

- a. piping
- b. ducts
- c. boilers
- d. turbines
- e. furnaces
- f. walls, ceilings, floor tiles, roofing, siding, glazing, caulking
- g. sprayed on acoustic and/or fireproofing materials
- h. textiles such as gasket rope, curtains, etc.
- i. soil
- j. vibration control mats
- k. elevator brakes and door insulation
- l. mastics

Examples of materials which may contain HBMs are as follows:

- a. light ballasts (PCBs)
- b. fluorescent lighting (mercury)
- c. high intensity direct (HID) lighting (mercury and heavy metals)
- d. water tower cooling waters (fungicides, heavy metals)
- e. hydraulic fluids, electrical coolant/lubricant oils (PCBs, heavy metals)
- f. batteries ( lead & other heavy metals, acids)
- g. fire suppression dump systems ( alkali compounds)
- h. computer boards ( heavy metals)

Examples of materials which may be biological hazards in buildings are as follows:

- a. bats and bat guano (rabies and fungi)
- b. feral cats and cat droppings (toxoplasmosis, ticks)
- c. pigeons and other birds ( guano with fungi and bacteria, ticks)
- d. rogue bee and wasp nests ( Africanized bees, allergic reaction potential)
- e. raccoons ( rabies)
- f. rodents ( bacteria, fleas and ticks)
- g. damaged septic tanks or drain fields ( bacteria, industrial wastes)

Military and former military sites may have been used for weapons storage or detonation. If the site has been used for these purposes, or is/was located along side of a rail line or spur, there is a potential for buried unexploded ordnance, chemical warfare test kits, radioactive materials, and the training aids associated with these items. The A-E shall contact the owning agency and determine if and when clearances have been made on the area. Documentation is usually done in the Environmental Assessment (EA), however, the EAs frequently state only that there is no record of anything ever being found and not the results of actual surveys or scans. It is important to identify the potential for these items early in the design process.

Unless there is a record of all ordnance and munitions stored, stating that no radioactive materials have been stored, storage igloos, pole barns, de-mil buildings, etc. shall be scanned radioactive compounds. Contact the USACE PM for assistance from the USACE HTRW Section as soon as possible if no documentation of inventories or scans can be located. Examples of materials or projects which may be radiological hazards in buildings, ranges or drop zones can include:

- a. Davy Crocket Systems
- b. nuclear motors
- c. spotting rounds
- d. Law Rockets
- e. tridium triggers
- e. depleted uranium (DU)
- f. 91B programs

Chemical Warfare Test Kits and Training Aids, grenades, triggers, fuses smoke bombs, and other miscellaneous materials are frequently buried along rail lines, at the edge of wooded areas, fence lines, marshes and other areas that were once considered marginal or remote in the 1950's through the 1970's. All RFPs and full designs that have a potential for encountering these materials shall include a clause that directs the Contractor to have work to perform in other areas of the site should these materials be encountered. Total stoppage of work should only occur if high explosives or large quantities of hazardous materials are present and require a wide safety set back. Contact the Installation Munitions experts and the USACE PM for assistance from the USACE HTRW Section as soon as suspect items are located. Work in this area may be delayed from 30 -120 days while materials are being removed.

## **12.2 REQUIREMENTS.**

12.2.1A-E Designer Requirements. The A-E shall comply with the provisions of this chapter for design purposes where the conditions indicate asbestos (friable and non-friable) or other hazardous building materials are to be encountered:

12.2.2 A-E Asbestos Designer Requirements The asbestos designer or consultant, and inspectors/samplers shall have attended an initial designers/inspectors Model Accreditation Program (MAP) training course and have successfully passed the examination. Annual refresher training with a successfully completed examination shall also be required. The designer and inspectors shall also be certified and licensed in the state in which the work is to be performed (e.g. state of North Carolina per state requirements if the project is in North Carolina, South Carolina if in the state of South Carolina, etc.) Copies of all licenses/state certifications shall be submitted and all related documents are to be signed with license numbers included with the signatures. The A-E shall comply with the provisions of this chapter

for design purposes where the following conditions indicate asbestos (friable or non-friable) are likely to be encountered:

- a. If the site is found to be or suspected of being asbestos contaminated and is to be demolished or renovated,
- b. If the ACM will be drilled, scraped, sanded, cut through, or penetrated, (such as encountered in replacing HVAC systems on roofs) thereby releasing asbestos or
- c. If any ACM will be enclosed or encapsulated.

12.2.3 A-E Hazardous Building Materials Designer Requirements. The designer or consultant shall have demonstrated advanced knowledge in the handling and disposal of hazardous materials. This requirement may be documented by having a baccalaureate degree related to hazardous chemical compounds, such as Toxicology, Public Health, or Chemical Engineering; or who has taken and passed examinations for certification programs such as a Certified Industrial Hygienist (CIH), Certified Industrial Hygiene Technician (CIHT), Certified Hazardous Materials Manager (CHMM), Certified Safety Professional (CSP) Certified Health Physicist (CHP) or who has had and can document extensive related training by a reputable state or acceptable training agency. The designer shall also meet any certification and license required by the state in which the work is to be performed. Copies of all licenses, degrees, or certifications shall be submitted as per section 12.4b and all related documents are to be signed by the designer with license or certification numbers included with the signatures. The A-E shall comply with the provisions of this chapter for design purposes where the following conditions indicate hazardous materials are to be encountered:

12.2.3.1 If the site is found to be or suspected of containing articles contaminated with hazardous materials and is to be demolished or renovated (lights, light fixtures, electrical or manometer switches, excessive bird droppings or other biological wastes, radioactive source, etc.),

12.2.3.2. If the hazardous material is to be removed and disposed of has potential for it's containment to be accidentally breached during renovations or is a material that must be disinfected or cleaned prior to renovation or demolition, thereby releasing it or

12.2.3.3 If any onsite hazardous material will be enclosed or encapsulated in-place by the renovation.

12.2.4 A-E Responsibilities for Asbestos. Demolition of asbestos material without Environmental Protective Agency (EPA) notification, or designated state agency note, and improper work practices can result in a \$10,000 per day fine being levied on both the building owner and Contractor. The Unified Facility Guide Specification 02 82 14.00 10 is written so that the construction contractor will be required to provide the written notifications and report to the EPA. In some states this function has been taken over by an approved state agency and notification will follow the requirements of the states to fulfill the EPA notification clause. It is the A-E's responsibility to determine existence, quantity, condition and location of asbestos material, to prepare contract documents recommending methods of disposing of the ACM, and to prepare an estimate of construction cost relating to the recommended methods.

12.2.5 A-E Responsibilities for Hazardous Materials. Demolition of buildings or structures without removal of hazardous materials result in a violation of Federal and state OSHA

requirements related to worker overexposure; violation of Department of Transportation hazardous materials transportation and shipping laws, or EPA/state landfill disposal laws. Although there are no UFGS specifications expressly written for each hazardous material that may be encountered, the A-E is responsible for determining the existence and location of hazardous materials, for preparing contract documents, recommending methods of removing and disposing of the hazardous materials, and for preparing an estimate of construction costs relating to the recommended methods. The A-E may use the Savannah District Hazardous Building Materials Removal specification (02 09 10) as a template to develop an appropriate specification, or may include such information in the Demolition and Deconstruction specification (UFGS-02 41 00). The A-E shall ensure that all methods meet Federal, State, and local requirements for the handling and disposing of hazardous materials, and that “cradle to grave” tracking is maintained. Contract documents shall require that all hazardous materials are delivered directly to the treatment storage and disposal center (TSD) and are not sent to holding or bulking facilities.

### **12.3 SITE VISIT.**

12.3.1 The A-E, meeting the requirements in 12.2, or his asbestos/hazardous building material consultant, shall perform a site investigation to determine the existence, physical condition and location of asbestos and hazardous building materials. The site visit shall include the taking of bulk samples from suspected locations and perform any necessary exploratory work on the site, using good engineering judgment. Sampling should not be taken if it renders the material unstable, or causes leaking or other deterioration of the base material or poses a hazard to those working in and around the building.

12.3.1.1 Asbestos surveys shall be performed using general procedures and protocols appearing in EPA 40 CFR, part 763, dated October 30, 1987 (ASHERA Protocols). However, all suspect asbestos containing materials, not just interior structures, shall be included in the survey. In obtaining the samples for testing, the A-E shall follow all OSHA/EPA/NIOSH safety requirements for personal and public safety, and must insure that the disturbed area will not increase the hazard from release of asbestos fibers or hazardous building materials.

12.3.1.2 A sufficient number of samples shall be analyzed to cover all suspect materials. Areas that cannot be sampled due to a “non destructive” clause, shall be noted in the asbestos and HBMs survey. Bulk asbestos samples with 1 percent (by volume) or greater content shall be considered asbestos containing material (ACM), and that material shall be designated for removal, enclosure or encapsulation. In most cases the building owner will want the ACM and HBM removed unless it is physically too difficult or dangerous to do or too cost prohibitive. A-E shall state encapsulation and enclosure as a last resort measure.

12.3.1.3 A sufficient number of samples shall be analyzed to cover all suspect hazardous materials. Areas that cannot be sampled due to a “non destructive” clause, shall be noted in the hazardous materials survey report or detailed in a letter of findings to the Project Manager. Equipment or objects (ballasts, lights, switches) that contain hazardous materials shall be removed from the building or structure as intact as possible. Biohazards, such as potentially infectious guano, may require bio-sampling and analysis. The presence of live animals may require live trapping and release (bats, snakes, birds, etc.) before waste materials can be removed. The materials shall be removed intact prior to a demolition and cleaned prior to a renovation. Large areas, such as laboratories, process/research and development areas that are suspected to be contaminated with chemical compounds, may require special testing,

removal and disposal of all effective furnishings and building components prior to general demolition or renovation.

12.3.2 Notification. The A-E shall immediately notify the Savannah District Project Manager of any hazardous material or highly friable, contaminated occupied areas that pose an immediate threat to the health of the occupants. A written notification shall immediately follow.

#### 12.4 ASBESTOS LABORATORY REQUIREMENTS.

12.4.1 Asbestos bulk samples shall be sent to a laboratory for testing to determine percent of asbestos, type of asbestos, and binding material, and the results documented with the Preliminary Design Analysis. Polarized light microscopy (PLM) analysis will be specified for initial screening. Analysis of floor tile and other resin-bound materials by the PLM method (EPA/600/R-93/116, July 1993) may yield false negative results because of method limitations in separating closely bound fibers and in detecting fibers of small length and diameter. Therefore, a qualitative assessment of vinyl floor tile, mastics, and some grouts may be done by the transmission electron microscopy (TEM) method. The qualitative analysis of vinyl tile and other materials by TEM shows that asbestos is either present in high portions or not present in detectable quantities. Floor tile qualitative TEM results shall be reported as "> 1 percent asbestos," "< 1 percent asbestos, trace," or "no asbestos detected." By specifying qualitative analysis for floor tile, considerable cost savings should be realized over the quantitative assessment by the TEM method.

12.4.2 Laboratories performing bulk asbestos analyses must utilize U.S.EPA's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" as found in 40 CFR Part 763, Subpart F, App. A. or the current EPA method for the analysis of asbestos in building material. Analyzing laboratories shall participate in the AIHA/NIOSH Bulk Asbestos Proficiency Analytical Testing (BAPAT) Program and shall have participated in at least 50 percent of the rounds within the last year and scored 90 percent or better. Details on BAPAT applications can be found on the Web at <http://www.aiha.org> or call (703) 849-8888.

12.4.3 All laboratories which analyze samples or materials (metals, silica, asbestos, lead, and solvents ) for the purposes of evaluating workplace exposures or contaminants shall be accredited under the AIHA Laboratory Accreditation Program (NAVLAP). The laboratories, as a part of the NAVLAP accreditation, shall successfully participate in the AIHA/NIOSH Proficiency Analytical Testing (PAT) Program and shall have participated in at least 50 percent of the rounds within the last year and scored 90 percent. Details on accreditation applications can be found on the Web at <http://www.aiha.org>. All fiber- counting analysts using the phase contrast microscopy method (PCM) must have successfully completed a NIOSH 582 course or equivalent.

12.4.4 All laboratories performing analysis of microorganisms commonly detected in air, fluids, and bulk samples shall be accredited under the Environmental Microbial Laboratory Accreditation Program (EMLAP). Proof of continued participation and competency in the AIHA Environmental Microbiology Proficiency Testing (EMPAT) is required.

#### 12.5 SURVEY REPORTS.

12.5.1 Proof of AIHA accreditation under the Laboratory Quality Assurance Program (LQAP) shall be required. Each location and type of lab, (Fixed Site, Mobile Facility and Field

Operation) shall have a separate accreditation. Details on accreditation applications can be found on the Web at <http://www.aiha.org>.

12.5.2 The asbestos and the HBM survey report shall contain single line floor plan sketches of the buildings and rooms, showing where samples were taken, indexed schedule of samples surveyed with the sample number and other pertinent notes, and a narrative on methodology of survey. The laboratory bulk sample report numbers will be correlated with the samples taken. Drawings shall be compatible in scale with all other drawings unless otherwise noted.

12.5.3 The presence (or absence) of other suspected hazardous materials shall be verified by similar applicable methods discussed above.

12.6 **APPLICABLE PUBLICATIONS.** The most current editions of the publications listed below constitute an addendum to this chapter wherever referenced or applicable.

Federal Standards No. 313A

NIOSH      The National Institute for Occupational Safety and Health  
Manual of Analytical Methods, Physical and Chemical Analysis  
Method

OSHA      The Occupational Safety and Health Administration

29 CFR 1910.1001, 29 CFR 1910.134, 29 CFR 1910.1200  
29 CFR 1926.58, 29 CFR 1926.1101

EPA      Environmental Protection Agency

40 CFR 61 Subpart A & M  
40 CFR Part 763, Oct 30, 1987  
EPA/600/r-93/116, July 1993

USACE      Guide Specification UFGS 02 82 14.00 10

Note: The above referenced agencies may be contacted at the following addresses:

- a. The National Institute for Occupational Safety and Health  
CDC-NIOSH  
Building J, N.E., Room 3007  
Atlanta, Georgia 30333
- b. The Occupational Safety and Health Administration  
200 Constitution Avenue  
Washington, D.C. 20210
- c. Environmental Protection Agency  
401 M Street, S.W.  
Washington, D.C. 20460
- d. The Corps of Engineers

Huntsville Engineering and Support Center  
<http://www.hnd.usace.army.mil>  
See TECHINFO/Publications

**12.7 PRECONCEPT SUBMITTAL REQUIREMENTS.** The A-E shall collect and evaluate all existing sampling data, records of removal, encapsulation, or enclosure of all known asbestos and the presence of hazardous materials. The A-E shall then prepare and submit a summation of known acceptable data and areas of no data or unacceptable data. It shall be the responsibility of the A-E to then prepare a schedule of when the data gaps will be filled (by site visits, surveys, etc.) This shall be presented in a tabular form. Photographs are not required, however a single photograph of the building, showing the building number is encouraged.

**12.8 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS.** The Concept Design Submittal shall include the following:

12.8.1 Criteria listings - standards, manuals, and all applicable references which will be used in developing the specification or the RFP.

12.8.2 Asbestos and hazardous materials survey report. The report shall include a description of findings in text and tabular form, following AHERA guidelines for physical condition and damage assessments. The report shall include all analytical support data such as field notes and chain of custody receipts. Technicians must sign all sampling documents, analytical results, and chain of custody receipts. In North Carolina (and any other states that require a professional or licensed oversight person), the report shall be signed by the CIH, CSP (or applicable professional). Sample locations shall correlate to site drawings. Drawings shall be compatible and to scale with all other site drawings. Text and drawings shall be submitted in hard copy and project compatible electronic format. All test methods and procedures shall be described and referenced. Areas unable to be sampled shall be noted and the reason given.

12.8.3 Written notification shall be made of any highly friable or damaged asbestos and asbestos contaminated areas that pose an immediate threat to the health of the occupants.

12.8.4 Certification and experience of A-E or consultant and all personnel performing asbestos and hazardous material sampling and abatement design shall be submitted. The function of each person shall be described with his/her certifications attached. All copies must be legible.

12.8.5 Name and certification of the asbestos/hazardous materials testing laboratory shall be submitted. See Section 12.1.6.8 Laboratory Accreditation.

12.8.6 Submit a narrative describing anticipated scope of work based upon survey findings. (Document building relative to making assumptions, including original construction date).

**12.9 PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS.**

12.9.1 Preliminary Design Analysis. In the event that 35 percent and 60 percent submittals are combined or a fast track RFP is being prepared, the USACE project manager may request that the asbestos or hazardous materials survey be submitted separately from standard submittal dates for USACE review in order to prevent design complications from unexpected materials discoveries.



12.9.1.1 The Preliminary Design Analysis shall include all items contained in the Concept/Early Preliminary Design submittal and any necessary changes as required. The A-E shall address and annotate all comments. Responses shall be grouped by reviewer and include reviewer's name, the question or comment, the A-E's response, and where in the text or drawing the changes were made.

12.9.1.2 The A-E shall furnish certified laboratory test results with the project Preliminary Design Analysis verifying the existence of asbestos by type, concentration level (in percent), location, condition, and binder type (including percent). The analysis of vinyl floor tile and mastics are an exception as noted earlier. Qualitative TEM analysis of bulk sample test results shall be reported as ">1 percent asbestos," "<1 percent asbestos, trace," or "no asbestos detected." Negative test reports are also required.

## 12.9.2 Preliminary Drawings.

12.9.2.1 Drawing(s) shall be submitted at Preliminary for all projects or portions thereof which contain asbestos (or other HBM).

12.9.2.2 The A-E shall provide demolition or renovation drawing(s) which show(s) any asbestos/HBM abatement work. Each drawing shall indicate the location of all HBMs and type of the asbestos with enough detail so that quantities can be estimated. Drawings shall contain markings based upon the type and location of the various materials found. A detailed key shall be included.

12.9.2.3 The drawings shall include a schedule of occupancy phasing, (if applicable).

12.9.2.4. In crawl spaces, where the dirt floor has been contaminated with asbestos, the A-E shall indicate the area of dirt to be removed to a minimum of 50 mm (2 inches) depth or greater as deemed necessary, and note whether the material is friable or non-friable.

12.9.2.5 Plate numbers will carry an "R- or H-" prefix for asbestos abatement. Work related to other HBMs may be located on "R- or H-" plates or elsewhere as is feasible.

12.9.2.6. If part of a larger set of drawings, all asbestos drawings shall be grouped together immediately following the site development drawings. Sheet and ring numbers shall follow sequentially with the other drawings in the set.

12.9.3 Preliminary Specifications. The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

## 12.10 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS.

12.10.1 Final Design Analysis. The Final Design Analysis shall be a refinement of the Concept Submittal and the Preliminary Design Analyses. If the Preliminary stage is not required, the Final Design Analysis shall include all items required in paragraphs 12.9 .

12.10.2 Final Drawings.

12.10.3 Final plans will be the refinement and completion of preliminary drawings. All comments from this office relating to concept and preliminary design shall be incorporated in the final drawings.

12.10.4 Where crowded conditions exist, sufficient sections and elevations will be shown to indicate clearly the exact location of the asbestos in relation to other items.

12.10.5 The number of floor plans, elevations, and details will be sufficient to enable the Contractor to perform a detailed estimate.

12.10.6 Final Specifications

12.10.7 Guide Specification, as noted above will either be developed by the A-E if a full design or required to be developed if an RFP. Where the RFP A-E is responsible for reviewing specifications, the A-E shall ensure that a MAP trained asbestos designer reviews the Contractor's specification.

12. 10.8 A copy of the "Asbestos Survey Report" shall be included as an appendix to the Asbestos specification. A copy of the survey report for other HBMs shall be included in the documents where applicable.

12. 10.9 The A-E shall include only final specifications in the Final Design or RFP submittal package.

#### 12.11 **CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.**

12.11.1 Notice. In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

12.11.2 Compliance. The comments generated during the Final Design review shall be incorporated in the Corrected Final submittal.

12.12 **ESTIMATE.** In preparing the Project Estimate, the costs of the asbestos and HBM abatement will be identified as a separate item for the quantity of asbestos involved. The Project Estimate shall include a detailed breakdown or backup data in the estimate for cost of the asbestos and/or hazardous building material professional (CIH, CSP, CHP, CHMM, etc.) for the project, permit filing costs, air and final cleanup, sampling and laboratory analysis costs, labor cost for abatement work for each of the major types of materials involved, transportation costs, and disposal costs.

12.13 **FEE PROPOSAL.** The A-E's fee proposal shall identify the material sampling and laboratory test analysis as a separate item.

\*\*\* End of Section \*\*\*

**HAZARDOUS BUILDING MATERIALS SURVEY AND REMOVAL**

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## CHAPTER A-13

### LEAD HANDLING AND REMOVAL

#### 13.1 GENERAL.

13.1.1 Scope. This chapter identifies the Architect-Engineer's (A-E's) responsibility for determining the existence of asbestos (and other regulated hazardous materials, HM's including lead and PCB's) and implementing the safeguards for its removal. Whenever asbestos containing material (ACM), or other HM is reported by the using military installation (Director of Engineering and Housing (DEH) or Base Civil Engineer (BCE) or is discovered by the Architect-Engineer during a field visit, the Architect-Engineer shall incorporate the provisions of this chapter into the design documents. Unless the using agency can provide location and quantities of asbestos through recent survey report of analytical sampling and testing results with the DD Form 1391, other programming documents, or supplemental data at the Predesign Conference, the A-E shall be responsible for determining the actual existence and/or nonexistence of asbestos on all renovation, rehabilitation, or demolition projects. Hazardous materials will be assumed present in all buildings built prior to 1980, unless verification is made otherwise. A-E will report building history (construction dates) with submittal. A-E firms that indicate an inability to determine the existence of asbestos (or other HM's) or implement safeguards for its removal due to insurance restrictions shall inform the Savannah District in writing at the submittal of the initial fee proposal. Asbestos (or other HM's) survey and abatement may then be accomplished independently by the Savannah District for incorporation into the construction documents.

13.1.2 Overview. Exposure to airborne asbestos has been associated with four diseases: lung cancer, gastrointestinal cancers, pleural or peritoneal mesothelioma, and asbestosis. Other regulated hazardous materials cause health problems. Lead is a poison and causes several health problems and can be deadly. The Environmental Protection Agency and the Occupational Safety and Health Administration have adopted regulations requiring control procedures of asbestos, lead, and PCB's and to ensure safe working conditions during demolition or renovation of buildings or structures. These procedures apply to any work that involves material which contains asbestos (or other HM's). Examples of materials which may contain or be covered by asbestos are as follows:

- a. piping
- b. ducts
- c. boilers
- d. turbines
- e. furnaces
- f. walls, ceilings, floor tiles, roofing, siding
- g. sprayed on acoustic and/or fireproofing materials
- h. textiles such as gasket rope, curtains, etc.
- i. soil

Lead may be contained in paint as well as, in soil and pavement where leaded gasoline was exposed, PCB's may be in light fixtures ballasts and in generators.

13.1.3 A-E Designer Requirements. The designer or consultant shall have attended a designers training course and successfully passed the examination. The designer shall also be certified in the State of North Carolina per state requirements if the project is in North Carolina. The A-E shall comply with the provisions of this chapter for design purposes where the following conditions indicate asbestos (friable or nonfriable) is to be encountered:

- a. If the site is found to be or suspected of being asbestos contaminated and is to be demolished or renovated,
- b. If the asbestos (and/or lead based paint, LBP) onsite will be drilled, scraped, cut through, or penetrated, thereby releasing asbestos (and/or lead), or
- c. If any onsite asbestos will be enclosed or encapsulated.
- d. If removal of PCB contained light fixtures or generators is required.

13.1.4 A-E Responsibilities. Demolition of asbestos material without Environmental Protective Agency (EPA) notification and improper work practices can result in a \$10,000 per day fine being levied on both the building owner and Contractor. The CEGS 02080 is written so that the construction contractor will be required to provide the written notifications and report to the EPA. It is the Architect-Engineer's responsibility to determine existence and location of asbestos material, to prepare contract documents recommending methods of disposing of the asbestos, (lead, or PCB) hazard(s), and to prepare an estimate of construction cost relating to the recommended methods.

#### 13.1.5 Site Visit.

13.1.5.1 The A-E with professional experience, or his consultant certified in the Comprehensive Practice of Industrial Hygiene (C.I.H.) and having specialized experience in sampling for asbestos, will perform a site investigation to determine the existence and location of asbestos material and shall take bulk samples from suspected locations and do any necessary exploratory work on the site, using good engineering judgement.

13.1.5.2 In obtaining the samples for testing, the A-E shall follow all OSHA/NIOSH safety requirements for personal and public safety, and insure that the disturbed area will not increase the hazard from release of asbestos fibers.

13.1.5.3 A sufficient number of samples shall be analyzed to cover all suspect materials. Samples with 1 percent or greater contamination by weight of asbestos shall be considered asbestos containing material (ACM), and that material shall be designated for removal, enclosure, or encapsulation.

13.1.5.4 The A-E shall notify the Savannah District Project Manager immediately, followed up in writing of any highly friable, contaminated, occupied areas which pose an immediate threat to the health of the occupants.

13.1.5.5 Nonfriable materials containing asbestos may not require testing, special handling, or disposal procedures unless such materials are to be sawed, pulverized, or handled in such a manner that will cause dust and asbestos fibers to be released.

13.1.5.6 The samples shall be sent to a laboratory for testing to determine percent of asbestos, type of asbestos, and binding material, and the results documented with the Preliminary Design Analysis. Polarized light microscopy (PLM) analysis will be specified for initial screening. Analysis of floor tile and other resinously bound materials by EPA Method 600/M4-82-020 Dec. 1982 may yield false negative results because of method limitations in separating closely bound fibers and in detecting fibers of small length and diameter. Therefore, a qualitative assessment of vinyl floor tile shall be done by the transmission electron microscopy (TEM) method. The quality analysis of vinyl tile by TEM shows that asbestos is either present in high portions or not present in detectable quantities. Floor tile qualitative TEM results shall be reported as "> 1 percent asbestos," "< 1

percent asbestos, trace," or "no asbestos detected." By specifying qualitative analysis only for floor tile considerable cost savings should be realized over the quantitative assessment usually done by the TEM method.

13.1.5.7 Laboratories analyzing bulk samples shall be participating in the Research Triangle Institute testing round robin (phone 919-541-6000 or 800-334-8571 EXT. 6741) and shall have participated in at least 50 percent of the rounds within the last year and scored 90 percent or better. Laboratories analyzing air samples shall be AIHA accredited and be proficient in the NIOSH PAT program.

13.1.5.8 The following is a list of possible laboratories capable of performing the sample analysis. This list is by no means all inclusive or an endorsement of any one of them. As of the latest writing of this manual, these laboratories meet the requirements listed above. The A-E shall confirm that the laboratory still meets the requirements before sending samples.

- a. Applied Technical Services, Inc.  
1990 Delk Industrial Blvd.  
Marietta, Georgia 30067  
(404) 423-1400
- b. James H. Carr and Associates, Inc.  
P.O. Box 90209  
Columbia, South Carolina 29202  
(803) 776-7789
- c. Q.A.S., Inc.  
4701 Joseph Michael Court  
Raleigh, North Carolina 27606  
(919) 851-2891  
P.O.C. John Sheats
- d. Georgia Tech Research Institute (GTRI)  
Georgia Institute of Technology  
Atlanta, Georgia 30332  
(404) 894-3825
- e. Research Triangle Institute  
P.O. Box 12194  
Research Triangle Park, North Carolina 27709  
(919) 541-6000  
(800) 334-8571 Ext. 6741

13.1.5.9 Survey Reports: The asbestos survey report shall contain single line floor plan sketches of the buildings and rooms, showing where samples were taken, indexed schedule of samples surveyed with the sample number and other pertinent notes, narrative on methodology of survey. The laboratory bulk sample report numbers will be correlated with the samples taken.

13.1.5.10 The presence (or absence) of other suspected hazardous materials shall be verified by similar applicable methods discussed above.

## 13.2 APPLICABLE PUBLICATIONS.

The most current editions of the publications listed below constitute an addendum to this chapter wherever referenced or applicable.

Federal Standards No. 313A

NIOSH The National Institute for Occupational Safety and Health  
Manual of Analytical Methods, Physical and Chemical Analysis  
Method

OSHA The Occupational Safety and Health Administration  
29 CFR 1910.1001  
29 CFR 1926.58

EPA Environmental Protection Agency  
40 CFR 61 Subpart A & M

Guide Specification CEGS-02080

EFARS 52.2/9009

Note: The above referenced agencies may be contacted at the following addresses:

- a. The National Institute for Occupational Safety and Health  
CDC-NIOSH  
Building J, N.E., Room 3007  
Atlanta, Georgia 30333
- b. The Occupational Safety and Health Administration  
200 Constitution Avenue  
Washington, D.C. 20210
- c. Environmental Protection Agency  
401 M Street, S.W.  
Washington, D.C. 20460

### 13.3 PRECONCEPT SUBMITTAL REQUIREMENTS.

No requirements for this section.

### 13.4 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS.

The Concept Design Submittal shall include the following:

- a. Criteria listings - standards, manuals, etc.
- b. Trip report, including a description of findings, sample locations, and test procedures.
- c. Written notification of any highly friable, asbestos contaminated, occupied areas which pose an immediate threat to the health of the occupants.
- d. Certification and/or experience of A-E or consultant performing asbestos sampling and asbestos/lead abatement design.

e. Name and certification of asbestos/lead testing laboratory

f. Narrative describing anticipated scope of work. (Document building relative to making assumptions, including original construction date).

### 13.5 **SIXTY PERCENT (60%) SUBMITTAL REQUIREMENTS.**

No requirements for this section.

### 13.6 **PRELIMINARY (60%) DESIGN SUBMITTAL REQUIREMENTS.**

#### 13.6.1 Preliminary Design Analysis.

13.6.1.1 The Preliminary Design Analysis shall include all items contained in the Concept Design submittal and any necessary changes as required.

13.6.1.2 The A-E shall furnish certified laboratory test results with the project Preliminary Design Analysis verifying the existence of asbestos by type, concentration level (in percent), location, condition, and binder type (including percent). The analysis of vinyl floor tile is an exception as noted earlier. Qualitative TEM analysis of sample test results shall be submitted reporting results as ">1 percent asbestos," "<1 percent asbestos, trace," or "no asbestos detected." Negative test reports are also required. The A-E shall furnish certified laboratory test reports with the project preliminary Design Analysis verifying the existence of lead, concentration of lead, location, and condition. Negative test results are also required.

#### 13.6.2 Preliminary Drawings.

13.6.2.1 Drawing(s) shall be submitted at Preliminary for all projects or portions thereof which contain asbestos (or other HM).

13.6.2.2 The A-E shall provide demolition or renovation drawing(s) which show(s) any asbestos abatement work.

13.6.2.3 Each drawing shall indicate the location of all HM's and type of the asbestos with enough detail so that quantities can be estimated.

13.6.2.4 The drawings shall include a schedule of occupancy phasing, (if applicable).

13.6.2.5 In crawl spaces, where the dirt floor has been contaminated with asbestos, the A-E shall indicate the area of dirt to be removed to a minimum of 25 mm (1 inch) depth or greater as deemed necessary, and whether the material is friable or nonfriable.

13.6.2.6 Asbestos abatement drawings will be prepared for color reproduction or will otherwise clearly delineate the asbestos work (only).

13.6.2.7 Plate numbers will carry an "R-" prefix for asbestos abatement. Work related to other HM's may be located on "R" plates or elsewhere as is feasible.

13.6.2.8 If part of a larger set of drawings, then all asbestos drawings shall be grouped together immediately following the site development drawings. Sheet and ring numbers shall follow sequentially with the other drawings in the set.



13.6.3 Preliminary Specifications. The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

### **13.7 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS.**

13.7.1 Final Design Analysis. The Final Design Analysis shall be a refinement of the Concept Submittal and the Preliminary Design Analyses. If the Preliminary stage is not required, the Final Design Analysis shall include all items required in paragraphs 13.4 and 13.6.1.

13.7.2 Final Drawings.

13.7.2.1 Final plans will be the refinement and completion of preliminary drawings. All comments from this office relating to concept and preliminary design shall be incorporated in the final drawings.

13.7.2.2 Where crowded conditions exist, sufficient sections and elevations will be shown to indicate clearly the exact location of the asbestos in relation to other items.

13.7.2.3 The number of floor plans, elevations, and details will be sufficient to enable the Contractor to perform a detailed estimate.

13.7.3 Final Specifications.

13.7.3.1 Guide Specification, as noted above will either be developed by the A-E if a full design or required to be developed if an RFP. Where the RFP A-E is responsible for reviewing specifications, the A-E shall ensure that a MAP trained asbestos designer reviews the Contractor's specification.

13.7.3.2 A copy of the "Asbestos Survey Report" shall be included as an appendix to the Asbestos specification. A copy of the survey report for other HM's shall be included in the documents where applicable.

13.7.3.3 The A-E shall include both marked up draft and final typed specifications in the Final Design submittal package.

### **13.8 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.**

13.8.1 Notice. In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

13.8.2 Compliance. The comments generated during the Final Design review shall be incorporated in the Corrected Final submittal.

### **13.9 ESTIMATE.**

In preparing the Project Estimate, the costs of the asbestos abatement will be identified as a separate item for the quantity of asbestos involved. Provide a detailed breakdown or backup data in

the estimate for cost of the Industrial Hygienists on job, permit filing costs, air and final cleanup sampling and laboratory analysis costs, labor cost for abatement work for each of the major types of materials involved, transportation costs, and disposal costs. The costs relative to handling other HM's shall be estimated in similar manner as described for asbestos.

#### 13.10 **FEE PROPOSAL.**

The A-E's fee proposal shall identify the material sampling and laboratory test analysis as a separate item.

\*\*\* End of Section \*\*\*

**SUSTAINABLE DESIGN**

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## CHAPTER A-14

### SUSTAINABLE DESIGN

#### 14.1 GENERAL.

14.1.1 Scope. This chapter states criteria, requirements and guidance for sustainable design. Specific submittal requirements in this chapter supplement the requirements of Volume 1.

14.1.2 Objective. The objective of the Corps of Engineers (COE) is to incorporate sustainable design into all projects to the maximum extent feasible in coordination with functional, operational, cost and other project requirements.

14.1.3 Requirement. Unless indicated otherwise in Specific Instructions or predesign conference, all projects shall comply with paragraph 14.2 Applicable Publications and the requirements of this chapter.

#### 14.1.4 LEED

14.1.4.1 LEED Certification of DoDEA Projects and Projects Located on Army Property. Generally, LEED certification at Silver level is required per Applicable Publications for all DoDEA projects that meet LEED Minimum Program Requirements (MPR) and for all projects located on Army property that meet LEED MPR. **For all projects that meet MPR, LEED Silver certification is required except when indicated otherwise in the predesign conference or Specific Instructions.**

14.1.4.2 LEED Certification of Air Force Projects Executed under LEED 2009/Version 3 if construction has not started should be revised to require third party certification under Guiding Principles. Generally, LEED certification at Silver level is required per Applicable Publications for all Air Force projects that meet LEED Minimum Program Requirements (MPR) and were registered under v3 prior to 30 December 2016. However Projects that were not registered under v3 prior to 30 December 2016 **WILL NOT** be certified under LEED v4, but rather use the Guiding Principles. These projects will require third party Guiding Principles certification either by Green Building Initiative (GBI) or Green Business Certification Incorporated (GBCI). Implementation guidance from the Air Force has been developed and should be followed.

14.1.4.3 LEED Minimum Program Requirements Determination. Determine whether the project meets all LEED MPRs at the beginning of the project. If you determine that LEED MPRs are not met, provide a narrative with the justification for this determination (that indicates the specific MPRs which are not met and why) no later than the first design submittal. Coordinate your determination with the Government.

14.1.4.4 Special Operations Forces (SOF) and Sensitive Projects that Meet MPR. For some projects the User prohibits posting drawings on the internet for security reasons. For all SOF projects and all other security-sensitive facility projects located on Army property, coordinate with the User regarding the acceptability of posting drawings and other project data at LEED Online prior to registering the project. If User prohibits online posting of drawings, coordinate with SAS Project Manager and prepare waiver request to do the following: meet all achievement requirements but not obtain formal certification, document all LEED credits in accordance with

USACE LEED-NC Submittals for Unregistered Projects spreadsheet and obtain qualified technical review of LEED documentation by SAS staff. Conform to instructions regarding exceptions to this policy in the 16 Dec 2013 Army SDD policy update memorandum (see Applicable Publications).

14.1.4.5 LEED Projects that Do Not Meet MPR. Projects that do not meet MPR are required to earn and document all feasible LEED prerequisites and credits and provide LEED documentation using and in accordance with USACE LEED Submittals for Unregistered Projects spreadsheet (document applicable to rating tool and version being used), located at <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx> . There is no minimum required number of points for these projects.

14.1.4.6 LEED Accredited Professional. For all projects using LEED provide a LEED Accredited Professional who is responsible for ensuring compliance with requirements herein, coordinating design review, ensuring correct interpretation of LEED credit requirements by the design team, providing guidance and assistance to PDT members in developing suitable and complete documentation, tracking overall LEED accomplishments, monitoring individual actions of PDT members responsible for each specific LEED credit, and ensuring LEED documentation is complete and correct and uploaded to LEED On-Line if applicable. In the case where multiple design teams are working on the same project the LEED AP will facilitate coordination between teams to complete the LEED documentation for the overall project.

#### 14.1.5 LEED Certification Projects

14.1.5.1 LEED Project Registration. All projects that require certification are required to be registered at LEED On-Line, use the LEED format and forms for project documentation, and have all project LEED documentation compiled at LEED On-line. For campus projects the party responsible for campus site design is also responsible for registering the Master Site and the campus Block, administering the Block and coordinating with all other involved building design teams. Due to the long duration of complex projects with several buildings using a campus site design is highly discouraged and no longer used by SAS District. Projects may have been previously registered during Code 3 activities. At the predesign conference coordinate with the Savannah District Project Manager (SAS PM) on whether the Government has previously registered any portion of the project. Unless indicated otherwise in Specific Instructions or predesign conference, register the project, pay registration fees, administer the on-line project and transfer the Project Administrator role for the registered on-line project to the SAS Project Manager when services are complete. **Registration requirement applies to all full design and Code 3 services.** See Technical Requirements paragraph 14.10 for instructions on registering projects, LEED registrations for RFPs and transfer of Project Administrator role.

14.1.5.2 Split Review. LEED Design Review (split certification) is required at the completion of final design for all full design projects that are registered. **For all full design registered projects, apply for LEED Design Review, pay Design Review fees to GBCI and coordinate directly with GBCI on review results. Apply for Design Review no later than 30 days after resolution of final design review comments.** In the case where multiple design teams are working on the same project, coordinate design review submission with the other teams (Master Site must be submitted first). Provide evidence of GBCI Design Review application date and

copies of all GBCI correspondence to Project Manager within 15 days of receipt. Coordinate with Project Manager and User as necessary, revise design and LEED documentation as necessary, resubmit/appeal denied design credits as necessary and provide technical language for amendments and contract modifications to Project Manager as necessary to achieve project LEED requirement. For projects attempting LEED certification Government review during project execution does not relieve or modify in any way the responsibility to satisfy all requirements for LEED certification as defined by GBCI.

#### 14.1.6 Commissioning and Commissioning Authority.

14.1.6.1 Full Design Projects with LEED Silver Requirement. For all full design projects with LEED Silver requirement the LEED Enhanced Commissioning credit is required and the Government will provide the Commissioning Authority (CxA) unless indicated otherwise in Specific Instructions or predesign conference. Coordinate with the CxA during design development on full designs.

14.1.6.2 Design-Build RFP Projects with LEED Silver Requirement. For all RFP projects with LEED Silver requirement the Design-Build (DB) Contractor will provide the Commissioning Authority (CxA) unless indicated otherwise in Specific Instructions or predesign conference. RFP commissioning requirement is to comply with UFC 1-200-02. Because LEED does not accept commissioning agent hired by DB Contractor, DB Contractor may attempt LEED Enhanced Commissioning credit but may not include this credit in their minimum number of points to meet required point total. Incorporate this in RFPs.

14.1.6.3 Other Projects. Assume Government will not provide the Commissioning Authority (CxA) unless indicated otherwise in Specific Instructions or predesign conference.

14.1.6.4 Thermal Comfort Verification. For all full design LEED v4 projects where the Government provides the Commissioning Authority (CxA) and the project earns Indoor Environmental Quality credit Thermal Comfort – Design credit, the CxA will perform all activities necessary to earn the credit for Thermal Comfort unless indicated otherwise in Specific Instructions or predesign conference.

14.1.6.5 LEED for Schools credit Mold Prevention. For all full design LEED for Schools projects where the Government provides the Commissioning Authority (CxA), the CxA will prepare the IAQ Profile and IAQ Management Plan unless indicated otherwise in Specific Instructions or predesign conference.

14.1.7 HPSB Compliance Checklists. See component level HPSB checklist requirements in UFC 1-200-02.

14.1.7.1 Energy & Sustainability Record Card. Regardless of the source of funds, a completed Energy & Sustainability Record Card is required for each non-Air Force building that is new construction with construction cost greater than \$3 million renovation of an existing building over 5,000sf with construction cost greater than \$3 million and 50% of Estimated Replacement Cost (ERC). See

<http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesi>

[gnCriteria.aspx](#) for E&S Record Card excel spreadsheet and follow “SAS Instructions for Completion of Energy & Sustainability Record Card” (also posted at same website).

14.1.7.2 Air Force MILCON Sustainability Requirements Reporting Score sheet. Required for all Air Force projects.

**14.2 APPLICABLE PUBLICATIONS.** The following publications form a part of this Manual. Comply with all Applicable Publications except where indicated otherwise.

UFC 1-200-02 High Performance and Sustainable Buildings Requirements, 1 December 2016, current version, located at [http://www.wbdg.org/ccb/browse\\_cat.php?o=29&c=4](http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4)

Air Force MILCON Sustainability Requirements Reporting Scoresheet (LEED 2009), located at <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx>

USACE Army LEED Implementation Guide, September 2014, located at <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx>

Memorandum, ASA(IE&E), 16 Dec 13, Subject: Sustainable Design and Development Update, located at [http://www.asaie.army.mil/Public/IE/doc/ASA\(IEE\)-SDD-policy-update-\(16-Dec-2013\).pdf](http://www.asaie.army.mil/Public/IE/doc/ASA(IEE)-SDD-policy-update-(16-Dec-2013).pdf)

DoDEA Facilities Management Guide “Sustainability and Energy Efficiency Program”

### **14.3 PRECONCEPT SUBMITTAL REQUIREMENTS.**

LEED Score Card Each scheme submitted shall include an initial LEED Score Card identifying the LEED points earned and those points which have good potential to be developed by the scheme. Each scheme and LEED Project Checklist shall include in the “Yes” column at least the minimum required points. Air Force projects - substitute Air Force MILCON Sustainability Requirements Reporting Score sheet for LEED Project Checklist.

### **14.4 CODE 3 DESIGN REQUIREMENTS.**

Comply with paragraph 14.1.3. Submittal content and format shall be as described in applicable year Project Definition Report (PDR) instructions (obtained from SAS PM).

14.4.1 LEED On-Line Project Registrations. **Register projects at LEED Online in accordance with paragraph 14.1.5.** Include LEED registration information in the PDR (rating tool, version, all registered block/project numbers and names, name of SAS PM that Project Administrator role has been transferred to).

14.4.2 HPSB Compliance Checklists. Submit HPSB Compliance Checklist for each applicable facility in accordance with paragraph 14.1.7.



#### 14.5 CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS.

14.5.1 LEED initial Score Card. Provide completed initial LEED Score Card for each building showing credits project will pursue. Air Force projects - substitute Air Force MILCON Sustainability Requirements Reporting Score sheet for LEED Project Checklist.

14.5.2 Owner's Project Requirements for Commissioning Document. Provide completed Owner's Project Requirements for Commissioning document as required by LEED Fundamental Commissioning prerequisite. A USACE Template for this document is available at <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx> . Use of this template is optional.

#### 14.6 PRELIMINARY (60%) SUBMITTAL REQUIREMENTS.

LEED Score Card Project Checklist. Provide a completed updated LEED Score Card for each building showing credits project will pursue. Implement concept submittal review comments. Air Force projects - substitute Air Force MILCON Sustainability Requirements Reporting Scoresheet for LEED Score Card.

#### 14.7 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS.

14.7.1 LEED Design Credit Documentation. **All LEED design credit documentation is due at Final Submittal.** This includes all Project Information Forms, all LEED-defined design prerequisites, all LEED-defined design credits attempted and the following credits if attempted: Protect or Restore Habitat, Heat Island Reduction and Measurement and Verification. If v3 construction credit MR6 is attempted, a spreadsheet indicating estimated total materials cost for and all specified rapidly renewable materials with quantities and estimated material costs for each is required as a final design submittal and attachment to SUSTAINABILITY specification. For registered projects provide completed Forms and all attachments. For unregistered projects provide all documentation and attachments indicated as due at final design in the applicable USACE LEED Submittals for Unregistered Projects spreadsheet located at <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx> . Provide completed LEED Project Checklist for each building showing credits that have been incorporated into the project. Implement all prior submittal review comments. Air Force projects – substitute the Air Force MILCON Sustainability Requirements Reporting Score sheet for LEED Project Score Card. **Include this as an appendix to the Final Design Analysis.**

14.7.2 LEED On-Line. For all registered projects upload all general project data (PI Forms and uploads) and design credit data required by LEED On-line by final submittal date.

14.7.3 LEED Boundary. Show and label all building LEED project boundaries and LEED campus boundaries as applicable **in contract drawings**. If LEED project boundary is coincident with project limits of construction, note this in contract drawings.

14.7.4 HPSB Compliance Checklists. Incorporate construction phase HPSB compliance checklist requirements for each applicable facility into contract documents in accordance with paragraph 14.1.7. Submit HPSB compliance checklist for each applicable facility in accordance with paragraph 14.1.7. Include HPSB compliance checklist(s) as an appendix to the Design Analysis.

14.7.5 Plans for Operation. Incorporate ASHRAE 189.1 Plans for Operation requirements into contract documents in accordance with paragraph 14.1.8. Coordinate with CxA and include CxA-required construction submittals in contract documents. Submit ASHRAE 189.1 Plans for Operation DOR documents in accordance with paragraph 14.1.8 as an appendix to the Design Analysis.

#### 14.8 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.

14.8.1 Corrected Final Submittal. In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments. **Submit all revised documents that show implementation of the comments.**

14.8.2 LEED Design Review. See paragraph 14.1.5.2 "Split Review" for design review application which occurs in conjunction with corrected final design.

14.8.3 HPSB Compliance Checklists. Submit HPSB compliance checklist **original excel file** directly to SAS PM for each applicable facility in accordance with paragraph 14.1.7.

#### 14.9 REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP SOLICITATION PACKAGES.

14.9.1 General. Comply with paragraph 14.1.3. Incorporate all applicable requirements of this chapter in the RFP.

14.9.2 HPSB Compliance Checklists. Submit HPSB compliance checklist **original excel file** directly to SAS PM for each applicable facility in accordance with paragraph 14.1.7.

#### 14.10 TECHNICAL REQUIREMENTS.

14.10.1 General. Comply with paragraph 14.1.3. Document all instances of noncompliance with justification in Design Analysis. If a waiver request is needed, prepare the waiver request and all supporting technical documentation.

14.10.2 Conflicts. Where UFC 1-200-02 conflicts with the USACE Army LEED Implementation Guide, UFC 1-200-02 shall take precedence (example: paragraph 18b "REQUIRED CREDITS" is not applicable). Where UFC 1-200-02 conflicts with AT/FP, fire protection or operational security requirements, those requirements take precedence.

14.10.3 SAS Guide Specifications. Several SAS UFGS are located at <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx> . They address many of the requirements in this paragraph. **Use these SAS UFGS** in all applicable projects. **Follow the specifier notes contained in these UFGS** for editing of specifications.

#### 14.10.4 LEED

14.10.4.1 LEED On-Line Registration Instructions. Comply with the following when completing LEED project registrations. Include these instructions in all DB RFPs that require LEED registration by DB Contractor.

##### A. Project Title:

1<sup>st</sup> part of title identify client - ARMY, AIR FORCE or DOD as applicable

2<sup>nd</sup> part of title - project number from DD1391

3<sup>rd</sup> part of title – project and building name as applicable (if a separate registration is needed for each building in the project the name needs to indicate which building)

EXAMPLE: “ARMY 55355 Bks Complex Ph3 COF 2”

EXAMPLE: “DoD 328166 McNair School”

EXAMPLE: “AIR FORCE 329238 Avionics Facility”

##### B. Project Owner Information

General Owner Organization: U.S. Army Corps of Engineers

May we publish project owner information? : pick “yes”

Owner Type: pick “Government Use: Federal”

Main Office: leave blank

Primary Contact: The Primary Contact is the USACE Project Manager. Confirmation of Agent Form is not needed.

##### C. Address

Populate the 2<sup>nd</sup> address line with 4 digit base identifier (see E&S Record Card instructions for these), 5 digit category code (on DD1391 under PRIMARY FACILITY) and RPUID if known (currently assigned at facility turnover, planned to be assigned and indicated on DD1391).

14.10.4.2 Government LEED Team Members. For all SAS registered projects invite and provide Team Manager Authorization level to SAS Project Manager. For all Fort Benning registered projects invite and assign “QA/QC” role to [whitney.m.ray2.civ@mail.mil](mailto:whitney.m.ray2.civ@mail.mil); For Fort Bragg registered projects invite and assign “QA/QC” role to: [Lynda.s.pfau.ctr@mail.mil](mailto:Lynda.s.pfau.ctr@mail.mil) ; for Fort Gordon registered projects invite and assign “QA/QC” to [kimberly.n.agyemang.civ@mail.mil](mailto:kimberly.n.agyemang.civ@mail.mil)

Include these instructions in all DB RFPs that require LEED registration by DB Contractor.

14.10.4.3 DoD Exemption to Sharing of Utility Data. Invoke this exemption on all projects (LEED 2009 and beyond – not applicable to v2.2). Follow instructions “MPR 6 Department of Defense Exemption Process” located at <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx> . Include these instructions in all DB RFPs.

14.10.4.4 Transfer of LEED Online Project Administrator Role. Comply with the following and incorporate these requirements in all construction contracts and DB RFPs as applicable.

A. CODE 3 SERVICES:

- Design team that performs Code 3 services obtains all LEED registrations and pays registration fees (person who registers is Project Administrator). No input beyond registration is required – project is registered at this time only to ensure it can be executed using the same rating tool under which it is budgeted and is not subject to LEED rating tool updates.
- Design team transfers Project Administrator role to SAS Project Manager (PM) at completion of Code 3 services.

B. DESIGN BID BUILD (DBB) PROJECTS:

- Designer of Record (DOR) obtains all required LEED registrations and pays registration fees (coordinate with SAS PM on prior registrations in predesign conference). For all prior registrations, SAS PM transfers Project Administrator role to DOR at start of design.
- DOR pays for and obtains GBCI Design Review.
- Construction contract requires Contractor to pay for and obtain LEED certification (responsibility for design credits and GBCI Design Review by others).
- DOR transfers Project Administrator role to SAS PM after GBCI Design Review is complete.
- SAS PM transfers Project Administrator role to Construction Contractor after award.
- If construction contract is awarded before GBCI design review is complete, DOR assigns Team Managers role to Construction Contractor POC at start of construction to provide interim access to LEED On-Line.
- Construction Contractor pays for and obtains final LEED certification and transfers Project Administrator role to SAS Project Engineer after final LEED certification is complete.
- SAS Project Engineer coordinates with installation and, according to their direction, either transfers Project Administrator role to installation POC or contacts GBCI to cancel the project.

C. DESIGN-BUILD (DB) PROJECTS

- If LEED registrations were obtained at Code 3, SAS PM transfers Project Administrator role to DB Contractor after award. If LEED registrations were not obtained at Code 3, DB Contractor obtains all required LEED registrations and pays registration fees (RFP Preparer coordinate with SAS PM on prior registrations during RFP development).
- DB Contractor pays for and obtains LEED certification and transfers Project Administrator role to SAS Project Engineer after final LEED certification is complete.
- SAS Project Engineer coordinates with installation and, according to their direction, either transfers Project Administrator role to installation POC or contacts GBCI to cancel the project.

14.10.4.5 LEED Credits by Others. **Do not** include any points that result from activities by anyone other than the Designer of Record, Commissioning Authority, Construction Contractor or Design-Build Contractor towards the project minimum required LEED achievement. If any LEED credits by others are proposed, include full and concise written documentation of all agreements associated with the credit(s) in the Design Analysis, put the credit(s) in the “maybe” column of the LEED Project Checklist, and exclude the credit(s) from the solicitation documents.

14.10.4.7 Male/Female Ratio. Incorporate the following instructions as applicable. Include these instructions in RFPs where applicable. A document titled DoD Gender Ratio Exemption containing these instructions is posted at <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx>.

USGBC has granted approval for all LEED v2.2, 2009 and v4 Department of Defense projects in regards to WEp1 Water Use Reduction to use a standard 80:20 male to female gender ratio in the water use calculations for the military occupants. This blanket approval applies to all Department of Defense projects registered under LEED v4, 2009 and v2.2 regardless of registration date.

**When a DOD project claims this exemption, they must provide the following within the Special Circumstances Narrative box in WEp1:**

*This is a project under U.S. Department of Defense ownership and is taking advantage of the approval that USGBC granted to the U.S. Department of Defense as of April 2, 2014 to use a standard 80:20 male to female gender ratio in the water use calculations for the military occupants.*

*Project Name: XXX*

*Project Address, City and State: XXX*

*DOD Base or Installation name: XXX*

**All other forms and documentation should be provided as typically required.**

14.10.5 Range Buildings. Coordinate with User on building compliance with LEED Minimum Program Requirements. If any building in the range project meets the Minimum Program Requirements then develop and show on drawings a LEED Project Boundary that complies with the Minimum Program Requirements. In this project type the LEED Project Boundary does not coincide with the project construction limits.

14.10.6 Schools. School projects will utilize the LEED for Schools rating tool instead of LEED-NC.

14.10.6.1 Environmental Site Assessment. The DOR shall review the environmental site assessment documents prepared by the Installation (as part of predesign coordination for DBB full design or included as an appendix in RFP by RFP Preparer in DB RFP) and provide all additional services and documentation needed to meet the LEED prerequisite requirements.

14.10.6.2 Reduced Parking/ Designated Carpool Parking. This credit may be attempted but may not be included in the minimum points required (LEED do not consistently accept DoDEA parking criteria as equivalent to local zoning).

14.10.6.2 School as a Teaching Tool. Do not attempt this credit. Owner documents will not be provided.

14.10.6.2 Joint Use of Facilities. Incorporate design features required for this LEED credit but do not attempt it (Owner documents will not be provided).

14.10.7 Fort Bragg Projects. Projects located at Fort Bragg are required to comply with Fort Bragg list of required and prohibited LEED credits and, for all Fort Bragg required credits not obtained, submit a Fort Bragg waiver form that indicating the reason for not obtaining the credit. Obtain current Fort Bragg list from SAS Project Manager. Obtain waiver Form from SAS Project

Manager if needed. Incorporate these requirements into full designs and RFPs for projects located at Fort Bragg.

\*\*\* End of Section \*\*\*

**CHAPTER A-15**  
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Revised July 2020

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**CHAPTER A-15**  
**INTERIOR DESIGN**

**15.1 GENERAL.**

15.1.1 Scope. This chapter states criteria, requirements and guidance for interior design. Specific submittal requirements in this chapter supplement the requirements of Volume 1.

15.1.2 Quality. The objective of the COE is to obtain attractive facilities that are designed using sound technical knowledge and constructed using recognized, good industry practices, as well as being cost effective. The design and construction shall incorporate those characteristics which will provide facilities with present and continuing utility, durability and desirability, and which will be economical to maintain for the life of the structure. The design shall also be such as to provide a safe and healthy environment.

15.1.3 Sustainable Design. The COE has a policy to support the design, construction, operation and reuse/removal of the built environment (infrastructure and buildings) in an environmentally and energy efficient manner. Chapter 14, Sustainable Design, contains detailed requirements.

15.1.4 Multiple Buildings. Unless directed otherwise, when a project includes multiple buildings drawings shall be sequenced so that each building has a separate stand-alone set of drawings. Sometimes project scope changes requires that options be identified.

15.1.5 Site Adapting. When site adapting standard working drawings or using earlier designs at other locations, the design changes will generally be limited to exterior revisions to comply with the Installation Design Guide or other applicable local criteria, the selection of alternate interior materials when such changes are economically justified and to changes necessary for updating for conformance to current criteria.

15.1.6 Renovations. On renovation and modification projects provide separate plans showing demolition work required. Indicate items to be removed with dashed lines and hatched/poche'd areas to clearly show quantities and extent. Provide demolition notes to clarify scope of demolition work.

**15.2 APPLICABLE PUBLICATIONS.** The following publications form a part of this Manual to the extent indicated by the references thereto. Most recent date at contract award is applicable.

**TI 800-01**      Technical Instructions, Design Criteria, 20 Jul 1998

UFC 3-710-01A    Code 3 Design with Parametric Estimating AKA **TI 802-01** Technical Instructions for Code 3 Design with Parametric Estimating

UFC 1-300-07A    Design Build Technical Requirements, AKA **TI 800-03** Technical Requirements for Design-Build

UFAS            Uniform Federal Accessibility Standards



ADAAG Americans with Disability Act Guidelines

UFC 3-120-10 INTERIOR DESIGN

US Air Force Interior Design Standards

UFC 3-600-01 Fire Protection Engineering for Facilities

NFPA 101 National Fire Protection Association, "Life Safety Code", current edition

UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings

### **15.3 CODE 3 DESIGN SUBMITTAL REQUIREMENTS.**

15.3.1 Submittal. Submittal content and format shall be as described in TI 802-01, "Technical Instructions for Code 3 Design with Parametric Estimating". Consult the Centers of Standardization for costs of COS building furnishings. Some are posted on their web sites. For Code 3 Report the cost in the 1391 has to be verified for each building. Drawings are generally not required at this stage.

### **15.4 SCHEMATIC (35%) DESIGN SUBMITTAL REQUIREMENTS.**

15.4.1 General. Submittal content and format shall be as described in UFC 3-120-10 Interior Design. This document is available from the Whole Building Design Guide, Unified Facilities Criteria, at <https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc>.

15.4.2 Structural Interior Design. Army Projects - Provide 35 percent submittal in accordance with UFC 3-120-10 Interior Design, Chapter 4 Structural Interior Design. **Establish general requirements and provide a concept furniture floor plan at this stage.**

Air Force Project – Provide 35 percent submittal in accordance with "Interior Design Presentation Format", Air Force.

15.4.3 Furniture, Fixtures, and Equipment. When required by contract, provide 35 percent submittal for Furniture/Fixtures and Equipment in accordance with UFC 3-120-10 Interior Design, Chapter 5 Furniture, Fixtures, and Equipment Interior Design. Establish general requirements and provide a concept furniture floor plan at this stage.

### **15.5 DESIGN DEVELOPMENT (60%) SUBMITTAL REQUIREMENTS.**

15.5.1 General. This submittal consists of a limited number of drawings. Its purpose is to check progress, functional layout and incorporation of concept review comments. Design does not stop at this submittal.

15.5.2 Implement concept submittal review comments.

15.5.3 Structural Interior Design. Provide 60 percent submittal in accordance with applicable "Interior Design Presentation Format" Air Force, or UFC 3-120-10 Interior Design, Chapter 4

Structural Interior Design. Include interior signage plans and message schedule. Note any special features such as changeable components. Note (building-attached) exterior signage locations and types on drawings. All exterior signage shall be in accordance with the "Installation Design Guide" for each respective Installation where applicable.

15.5.4 Furniture, Fixtures, and Equipment Design. When required by contract, provide 60 percent submittal in accordance with applicable "Interior Design Presentation Format" Air Force, or UFC 3-120-10 Interior Design, Chapter 5 Furniture, Fixtures, and Equipment Interior Design. Submit furniture/furnishing plans for each floor showing the location and type of all furniture and furnishings as programmed by the project. When required by contract, indicate by schedule which items shall be furnished and/or installed by the Contractor and which shall be furnished and/or installed by the Government.

15.5.5 Specifications. The concept submitted Unified Facilities Guide Specifications (UFGS) list shall be updated to include any new specifications based on the refined preliminary design. All specifications from the list shall be tentatively marked up, with major edits, and submitted as part of the preliminary (60 percent) submittal. Specifications shall comply with the requirements of Chapter A-11, SPECIFICATIONS. Specifications shall be submitted with red-line edits indicating all deleted/modified text.

## **15.6 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS.**

15.6.1 Implement Concept and Preliminary review comments.

15.6.2 Structural Interior Design. Provide final submittal in accordance with applicable "Interior Design Presentation Format" Air Force, or UFC 3-120-10 Interior Design, Chapter 4 Structural Interior Design.

15.6.3 Furniture, Fixtures, and Equipment. When required by contract, provide final submittal in accordance with UFC 3-120-10 Interior Design, Chapter 5 Furniture, Fixtures, and Equipment Interior Design.

## **15.7 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.**

15.7.1 In the Corrected Final Design Submittal, the designer of record finalizes the construction documents. This includes the incorporation of approved comments from the previous design submittal reviews. The Corrected Final Design Submittal requirements shall be the same as the Final Design Submittal requirements. Unless indicated otherwise in the project Specific Instructions, this submittal will not be another review in ProjNet and is only for final backcheck of all comments.

15.7.2 Implement final review submittal comments.

15.7.3 Verify consistency between plans, specifications and final corrections.

## **15.8 REQUIREMENTS FOR PREPARATION OF DESIGN/BUILD RFP PACKAGES.**

15.8.1 General. Unless indicated otherwise, RFP shall be based upon "partial" design development as defined by TI 800-03 "Technical Instructions for Design-Build".

## 15.9 TECHNICAL REQUIREMENTS.

### 15.9.1 General.

15.9.1.1 In addition to the Criteria contained in the following paragraphs, interior design shall comply with technical instructions. Materials and construction methods shall comply with the instructional notes inserted in the applicable guide specifications.

15.9.1.2 Structural Interior Design. Structural Interior Design (SID) is required for all projects unless specifically deleted by contract. In general, the SID provides samples of all interior and exterior finishes and signage.

15.9.1.3 Furniture, Fixtures, and Equipment. Furniture/Fixtures and Equipment (FF&E) is provided only when required by contract. In general, the FF&E is an expansion of the SID that also addresses furniture and accessories. Furniture and accessories are purchased separate from the construction contract. When FF&E is requested the A-E provides both the SID and FF&E required items.

15.9.1.4 Format and Content. The format and content of SID and FF&E shall be in accordance with "Interior Design Presentation Format", dated November 1996, by Air Force Center for Environmental Excellence for all Air Force projects or in accordance with "Interior Design Requirements", dated Mar 2005, by U.S. Army Corps of Engineers, Savannah District, for all other projects except as modified in this chapter. When a FF&E is required, it will be formatted in a separate binder as described in paragraph 4.3 Furnishings, Fixtures & Equipment Finder of "Interior Design Requirements".

15.9.1.5 Number of Copies. Six copies are required at each submittal unless indicated otherwise in the contract. Each copy is to have actual physical samples unless indicated otherwise in the contract.

### 15.9.2 Finishes.

15.9.2.1 Color Schedules. Color for color schedules (excluding prefinished items) for all Ft. Bragg, NC projects shall be selected from FED-STD 595b. For all other projects, the use of FED-STD 595b for color schedules (excluding prefinished items) is optional. FED-STD 595b Color Fan Deck, with color chips for desk use, and 75 x 175 mm (3-inch by 5-inch) color chips by sets, can be ordered from the following address. (Cost of \$72.00)

Global Engineering Documents  
15 Inverness Way East  
Englewood, CO 80112-5704  
1-800-854-7179

15.9.2.2 Finishes Disclaimer. Interior and exterior finishes may be specified by using manufacturer and product names. When this is done, a disclaimer must be placed on the drawings or in specification 09000 where this is done that states the following:  
“The manufacturer's names and their products referenced indicate the color, texture, and pattern required for the materials listed. The products furnished shall meet the color, texture, and pattern indicated as well as the material quality and performance specified in the applicable technical section. The use of manufacturer's names and products do not preclude the use of other manufacturer's products of approved equal color, texture, and pattern as long as all requirements in the technical sections are met”.

15.9.3 Handicapped Accessibility. Where facilities for the handicapped are to be included in whole or in part, the design shall be in accordance with the American With Disabilities Act Accessibility Guidelines (ADAAG), and Uniform Federal Accessibility Standards (UFAS). In case of conflict, the more stringent requirement shall be followed.

#### 15.9.4 Structural Interior Design (SID)

15.9.4.1 Use of SID. The SID is used during design to review color and finish selections, prewired workstations, and signage design. It is used by Government personnel during construction in review of contractor submittals. The construction contractor does not receive the SID; it is an internal document only and not part of the construction contract documents. All information relating to building finishes, prewired workstations and signage must be in the contract documents. **DO NOT REFERENCE THE SID IN THE CONTRACT DOCUMENTS.**

15.9.4.2 Prewired Workstations. Prewired workstations (systems furniture) are included in the FF&E portion for certain projects. When this is the case, the construction contract documents will include prewired workstation design on I-Plates showing the location of the panels, worksurfaces, storage components, and other elements of the typical workstations. All coordination with electrical/telephone/computer outlets will be indicated. The workstation layouts are provided for review by the Government to verify coordination of all disciplines, and the purchase of the furniture is not part of the construction contract. A disclaimer will be indicated on the I-Plate. All finishes and procurement information shall be included in the FF&E submittal.

15.9.4.3 Special Requirements. The interior designer shall identify items in the SID or FF&E that require attachment to the building either by cutting or fitting. The designer must prepare specifications and drawings for this service to be performed.

#### 15.9.5 Furniture/Fixtures and Equipment.

15.9.5.1 Use of FF&E: The FF&E is used during design to review proposed finishes and furniture layouts coded to the furniture illustrations, furniture items, fabrics, colors, and furniture costs. It is used by the Government purchaser to procure the furniture. It is used by the User to direct installation to verify that furniture items received match what was ordered. It is used by Government personnel who administer the construction contract.

15.9.5.2 Scope. The FF&E is to include accessories such as lamps, clocks, framed artwork, artificial plants, trash receptacles, draperies, bedspreads in addition to furniture, finishes and signage.

15.9.5.3 Sources of Furniture. The Government is required to purchase furnishings from mandatory sources. This includes GSA Federal Supply Service and UNICOR, see paragraph 15.9.3.5. If the products offered by these sources do not meet the project requirements, then furnishings can be purchased from commercial vendors that have GSA contracts under GSA's Multiple Award Schedules. Many commercial furniture companies have GSA contracts with pre-negotiated prices. Only when none of these sources can meet the project requirements can open market items be purchased. When selecting furnishings, always review mandatory sources first, then GSA contract sources, then open market sources. When the interior designer determines FF&E items available on contract do not meet the functional requirements, or there is no current GSA resource, a waiver to use open market sources is required. The designer shall write a waiver/justification letter with salient features of that item. The letter shall be addressed to:

Director of Furniture Commodity Center  
GSA/FSS/FCNE  
Crystal Mall Building #4, Room 1010  
Washington, DC 20406

This letter shall be included on the FF&E binder attached to the applicable order form.

15.9.5.4 Quality of Products. The designer is to determine the project requirements and then select furnishings that meet these requirements. The products offered through mandatory government sources and GSA contracts represent a very wide range of quality and features. Being included in a GSA contract does not mean that a product meets any minimum quality standard. It is the responsibility of the designer to research products and determine their acceptability.

15.9.5.5 UNICOR Waiver. All furniture/furnishings shall be selected under the guidance of the National Defense Authorization Act – FY 2002, S1438, Title VIII, Subtitle B, Sec 811, Para 2410 which states UNICOR is no longer a mandatory source for furniture and a waiver is **not required from UNICOR** on items before selecting from the GSA Schedules. However, UNICOR shall be considered as a vendor to determine if UNICOR offers the “best value” product in terms of quality, price, and timeliness. If an UNICOR product is not the “best value”, then GSA Schedules shall be used for selection of furniture/furnishings. Three GSA vendors shall be considered but only one selected for the prepared Illustration Order Form. A Best Value Determination Guideline Sheet shall be filled out for each vendor whose furniture has been specified and the sheet provided in the FF&E binder. (This is in addition to the requirement under 15.9.1.4 Format and Content.) All furniture/furnishings shall be selected from GSA Schedules. The GSA web site is: [www.gsa.gov](http://www.gsa.gov). The UNICOR web site is: [www.unicor.gov](http://www.unicor.gov).

15.9.5.6 Customer's Own Material (COM). COMs are not permitted, except when selecting fabrics for Army barracks projects designed under the Interior Design Manual for Single Soldier Housing and submitted to the COE Huntsville District for procurement. A copy of the manual maybe ordered by contacting: [www.hnd.usace.army.mil](http://www.hnd.usace.army.mil).

15.9.5.7 Personal Computers. Design of all workstations and office furniture, including executive offices, should assume the use of a personal computer and accommodate it with an articulating keyboard tray and corner work surface where feasible.

15.9.5.8 Medical Projects. For medical projects where furniture items are included on the equipment list provided by the Government, the FF&E location codes will be the JSN numbers from the equipment list.

\*\*\* End of Section \*\*\*

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## CHAPTER A-16

### BUILDING INFORMATION MODELING

#### 1.0 GENERAL

- 1.1. Definitions. See Section 7 for definitions of terms used in this document.
- 1.2. Submittal Format
  - 1.2.1. The Model shall be developed using Building Information Modeling (“BIM”) supplemented with Computer Aided Design (“CAD”) content as necessary to produce a complete set of Construction Documents. Submitted drawings shall be 22”x34” full size, suitable for half-size scaled reproduction.
  - 1.2.2. BIM submittals shall conform to the requirements of Sections 3.0 and 4.0 below.
  - 1.2.3. For each structure included in the Project, all Models and associated Facility/Site Data shall be submitted in either Bentley Systems v8i BIM or Autodesk Revit 2011 format or higher. The submittals shall be fully operable, compatible, and editable within the native BIM tools.

#### 2.0 BIM REQUIREMENTS

- 2.1. Use of BIM. Contractor shall use BIM application(s) and software(s) to develop Projects consistent with the following requirements.
  - 2.1.1. Baseline Model. The Contractor will not be provided a baseline multi-discipline BIM Project Model.
  - 2.1.2. BIM Program Configuration Standards. If Contractor selects Bentley Systems BIM as the BIM platform of choice, the latest version of the Bentley TriServices Workspace must be used and can be downloaded from the CAD/BIM Technology Center website, currently <https://cadbimcenter.erdcdren.mil/Default.aspx>. For Revit Versions 2011 or earlier, a USACE Revit Standard will not be provided; Contractor can select which Revit templates and resources to use. For Revit 2013, the USACE Revit 2013 Templates must be used and can be downloaded from the CAD/BIM Technology Center website, currently <https://cadbimcenter.erdcdren.mil/Default.aspx>.
  - 2.1.3. Reference. Refer to ERDC TR-06-10, “U.S. Army Corps of Engineers Building Information Modeling Road Map” from the CAD/BIM Technology Center website for more information on the USACE BIM implementation goals.
  - 2.1.4. Industry Foundation Class (IFC) Support. The Contractor’s selected BIM application(s) and software(s) must be consistent with the current IFC property sets. Any deviations from or additions to the IFC property sets for any new spaces, systems, and equipment must be submitted for Government acceptance.
  - 2.1.5. BIM Project Execution Plan.



- 2.1.5.1. Develop a BIM Project Execution Plan (“Plan” or “PxP”) documenting mandatory and Contractor-elected BIM Uses, analysis technologies and workflows.
- 2.1.5.2. Contractors shall use the USACE BIM PROJECT EXECUTION PLAN (PxP) Template located at <https://cadbimcenter.erdc.dren.mil/Default.aspx> to develop an acceptable Plan.
- 2.2. BIM Content.
  - 2.2.1. Facility/Site Data. Develop the Facility/Site Data to include material definitions and attributes that are necessary for the Project facility design and construction as described in Section 4.0. Additional data in support of Section 6.0 Contractor Electives is encouraged to be added to the Model.
  - 2.2.2. Model Content. The Model and Facility/Site Data shall include, at a minimum, the requirements of Section 4.0 below.
- 2.3. Output. Submitted Drawings (e.g., plans, elevations, sections, schedules, details, etc.) shall be derived (commonly known as extractions, views or sheets) from the Model and Facility/Site Data. Drawings derived from the Model shall remain connected to the Model for the life of the Project and documented in the PxP. Drawings not derived from the Model shall also be documented in the PxP.
  - 2.3.1. Drawings derived from the Model shall be compliant with the A/E/C CAD Standard. Deliver electronic CAD files used for the creation of the Construction Documents per requirements of the USACE Savannah District.
  - 2.3.2. The CAD file format specified for drawings shall not dictate which application(s) are used for development and execution of the Model and Facility/Site Data. Application(s) used shall be documented in the PxP.
- 2.4. Quality Control Parameters. Implement quality control (“QC”) parameters for the Model, including:
  - 2.4.1. Model Standards Checks. Provide QC checks demonstrating that the Project Facility/Site Data set has no undefined, incorrectly defined or duplicated elements. Identify and report non-compliant elements and submit a corrective action plan. Provide the Government with detailed justification and request Government acceptance for any non-compliant element that the Contractor proposes to be allowed to remain in the Model.
  - 2.4.2. CAD Standards Checks. Provide QC checks demonstrating that the fonts, dimensions, line styles, levels and other construction document formatting issues are followed per requirements of the USACE Savannah District. Identify and report non-compliant content and submit a corrective action plan.
  - 2.4.3. Other Parameters. Develop such other QC parameters as Contractor deems appropriate for the Project and provide to the Government for acceptance.
- 2.5. Design and Construction Reviews. The Model and Facility/Site Data will be used to perform reviews at each submittal stage under Section 3.0 to test the Model, including Over-The-Shoulder Progress Reviews:

- 2.5.1. Visual Checks. Checking to demonstrate the design intent has been followed and that there are no unintended elements in the Model.
- 2.5.2. Interference Management Checks. Locate conflicting spatial data in the Model where two elements are occupying the same space. Log hard interferences (e.g., mechanical vs. structural, or mechanical vs. mechanical, overlaps in the same location) and soft interferences, (e.g., conflicts regarding equipment clearance, service access, fireproofing, insulation, code space requirements) in a written report and resolve.
- 2.5.3. Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model, including interference management and design change tracking information.
- 2.6. Other Parameters. Develop other design and construction review parameters as the Contractor deems appropriate for the Project and provide to the Government for acceptance.

### **3.0 BIM SUBMITTAL REQUIREMENTS**

#### **3.1. General Submittal Requirements.**

- 3.1.1. Provide submittals in compliance with the PxP deliverables at stages as described below.
- 3.1.2. For each Submittal as set forth in Paragraphs 3.3 through 3.5, provide a Contractor-certified written report confirming that consistency checks as identified in Paragraphs 2.4 and 2.5 above have been completed. This report shall be discussed as part of the review process and shall address cross-discipline interferences, if any.
- 3.1.3. At each Submittal as set forth in Paragraphs 3.3 through 3.5, provide the Government with:
  - 3.1.3.1. The Model, Facility/Site Data, Workspace and CAD Data files in the native BIM/CAD format.
  - 3.1.3.2. A copy of the Model in an interactive review format such as Bentley Navigator, Autodesk Navisworks, Adobe 3D PDF 7.0 (or later), Google Earth KMZ or other format per PxP requirements. The format for reviews can change between submittals.
  - 3.1.3.3. A list of all submitted electronic files including a description, directory, and file name for each file submitted. For all CAD printed sheets, include a list of the sheet titles and sheet numbers. Identify which files have been produced from the Model and Facility/Site Data.
  - 3.1.3.4. IFC Coordination View. Provide an IFC Coordination View in IFC Express format for all deliverables. Provide exported property set data for all IFC supported named building elements.
- 3.1.4. The Government shall confirm acceptability of all submittals identified in Section 3.0 in coordination with the USACE Savannah District BIM Manager.
- 3.2. Initial Design Conference Submittal.

- 3.2.1. Submit a digital copy of the PxP and M3. The USACE Savannah District BIM Manager to confirm acceptability of the Plan or advise as to additional processes or activities necessary to be incorporated into the PxP.
- 3.2.2. Within thirty (30) days after the acceptance of the PxP and M3, conduct a demonstration to review the Plan for clarification, and to verify the functionality of planned Model technology workflow and processes. If modifications are required, the Contractor shall complete the modifications and resubmit the PxP performing a subsequent demonstration for Government acceptance. There will be no payment for design or construction until the PxP is completed and accepted by the Government. The Government may also withhold payment if there is design and construction for unacceptable performance in executing the accepted PxP.
- 3.3. Interim Design Submittals.
- 3.3.1. BIM and CAD Data. Submit the Model with Facility/Site Data per the requirements identified in Paragraphs 2.2 and 2.3 as applicable to the Interim Design package(s).
- 3.4. Final Design Submissions and Design Complete Submittals.
- 3.4.1. BIM and CAD Data. Submit the Model with Facility/Site Data per the requirements identified in Paragraphs 2.2 and 2.3. Acceptance according to Paragraph 3.1.4 is required before commencement of construction.
- 3.5. Final As-Built BIM and CAD Data Submittal. Submit the final Model, Facility/Site Data, and CAD files reflecting as-built construction conditions for Government acceptance, as specified in Section 01 78 02.00 10, Closeout Submittals.

#### **4.0 MINIMUM MODELING AND DATA REQUIREMENTS**

- 4.1. Minimum Modeling Matrix (M3)
- 4.1.1. Develop an M3 documenting elements included in the facility and site. The M3 describes the minimum modeling and data requirements by defining the Level of Development ("LOD") and Element Grade.
- 4.1.2. Contractors shall use the USACE Minimum Modeling Matrix (M3) Template located at <https://caddbimcenter.erdc.dren.mil/Default.aspx> and submitted as part of the PxP.
- 4.2. Additional Requirements.
- 4.2.1. Classification. All modeled elements shall include Facility/Site Data referencing one or more classification system(s).
- 4.2.2. Spatial Data. The Model shall include spatial data defining actual net square footage and net volume, and holding data to develop the room finish schedule including room names and numbers. Include program information to verify design space against programmed space, using this information to validate area quantities.

- 4.2.3. Schedules. Schedules shall be produced from the Facility/Site Data within the Model. Any exceptions should be documented in the PxP and submitted to the USACE for review.
- 4.2.4. Details and Enlarged Sections. All details and enlarged sections necessary for construction shall be derived from the Model when possible. For those details and enlarged sections not derived directly from the Model, Contractor must verify that geometry and data depicting the details and enlarged sections are consistent with Model elements. Details with significant drafted content such as 'standard' and 'typical' details shall not contradict the model and shall utilize the model as an underlay when possible for the purposes of verification and coordination. Three dimensional, isometric, and section isometric details derived from the model are preferred.
- 4.2.5. Legends. Model Elements shall be used to produce representations shown in the legends and shall match graphical representations shown in plans, sections, and elevations.
- 4.2.6. Drawing Indices. Where BIM authoring platform supports it, drawing indexes should be derived from a model-driven schedule.

## **5.0 OWNERSHIP AND RIGHTS IN DATA**

- 5.1. Ownership. The Government has ownership of and rights at the date of Closeout Submittal to all CAD files, BIM Model, and Facility/Site Data developed for the Project in accordance with FAR Part 27, clauses incorporated in Section 00 72 00, Contract Clauses and Special Contract Requirement 1.14 GOVERNMENT RE-USE OF DESIGN (Section 00 73 00). The Government may make use of this data following any deliverable.

## **6.0 CONTRACTOR ELECTIVES**

- 6.1. Applicable Criteria. If the Contractor elected to include one or more of the following features as an elective in its accepted contract proposal for additional credit, as described in the proposal submission requirements and evaluation criteria, the requirements of paragraphs 6.2 through 6.5 are as applicable for those elective feature(s) that will be included in the project.
- 6.2. COBIE Compliance. The Model and Facility/Site Data for the Project shall fulfill Construction Operations Building Information Exchange (COBIE) requirements on the Whole Building Design Guide website ([www.wbdg.org](http://www.wbdg.org)) , including all requirements for the indexing and submission of Portable Document Format (PDF) and other appropriate records that would otherwise be printed and submitted in compliance with Project operations and maintenance handover requirements.
- 6.3. Project Scheduling using the Model. In the PxP and during the Initial Design Conference Submittal Demonstration, provide an overview of the use of BIM in the development and support of the Project construction schedule.
  - 6.3.1. Submittal Requirements. During the Stages identified in Paragraphs 3.3 through 3.4, the Contractor shall deliver the construction schedule linked to the Model.
    - 6.3.1.1. Construction Submittals – Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model for Project scheduling.

- 6.4. Cost Estimating. In the PxP and during the Initial Design Conference Submittal Demonstration, provide an overview of the use of BIM in the development and support of cost estimating, or other costing applications such as comparative cost analysis for proposed changes and estimate validation.
- 6.4.1. Submittal Requirements. During the Stages identified in Paragraphs 3.3 through 3.5, the Contractor shall deliver cost estimating information derived from the Model.
- 6.4.2. Project Completion. At Project completion, the Contractor shall provide an Micro Computer Aided Cost Estimating System Generation II (“MII”) Cost Estimate that follows the USACE Cost Engineering Military Work Breakdown System (“WBS”), a modified Uniformat, to at least the sub-systems level and uses quantity information supplied directly from Model output to the maximum extent possible, though other "gap" quantity information will be included by the contractor as necessary for a complete and accurate Cost Estimate. (See Paragraph 6.4.2.2).
- 6.4.2.1. Sub system level extracted quantities from the Model for use within the Estimate shall be provided according to how detailed line items or tasks should be installed/built so that accurate costs can be developed and/or reflected. When developing a Model, the contractor shall be cognizant of construction sequencing at the beginning stages of Model development, such as recognizing tasks performed on the first floor versus the same task on higher floors that will be more labor intensive and, therefore, need to have a separate quantity and be priced differently. Tasks and their extracted quantities from the Model shall be broken down by their location (proximity in the structure) as well as the complexity of installation.
- 6.4.2.2. At all design Stages it shall be acknowledged that BIM output will not generate all quantities that are necessary in order to develop a complete and accurate cost estimate of the Project based on the design alone. (An example of this would be plumbing that is less than 1.5" diameter and, therefore, not expected to be modeled due to permitted level of design granularity; this information is commonly referred to as “The Gap”. Quantities addressing “The Gap” and their associated costs shall be included in the final Project actual Cost Estimates as well even though not derived directly from the Model data).
- 6.5. Other Analyses and Reports. Structural, energy and efficiency, EPACT 2005 & EISA 2007, lighting design, daylighting, electrical power, psychrometric processing, shading, programming, LEED, fire protection, code compliance, Life Cycle Cost, acoustic, plumbing and other analyses that may be generated from the Model or reports summarizing the data compiled from these analyses shall be submitted in the form established by contractor in its accepted PxP.

## **7.0 Section 7 - Definitions**

- 7.1. The following definitions apply specifically to the USACE BIM Requirements.
- 7.1.1. “Model”: A digital representation of physical and functional characteristics of a facility or a part thereof, comprised of “Model Elements” with “Facility/Site Data”.
- 7.1.2. “Model Element”: A self-contained element with a unique identification, whose behavior and properties are defined by Facility/Site Data and software processes. Model Elements can

represent a physical entity, such as a pump or a concrete wall, and range from the simple to the complex.

- 7.1.3. “Facility/Site Data”: The non-graphical information attached to objects in the Model that defines various characteristics of the object. Facility/Site Data can include properties such as parametric values that drive physical sizes, material definitions and characteristics (e.g. wood, metal), manufacturer data, industry standards (e.g. AISC steel properties), and project identification numbers. Facility/Site Data can also define supplementary physical entities that are not shown graphically in the Model, such as insulation around a duct, hardware on a door, content of conduit, or transformer properties.
- 7.1.4. “Workspace”: A collection of content libraries and supporting files that define and embody a BIM standard. A workspace includes BIM libraries such as wall types, standard steel shapes, furniture, HVAC fittings, and sprinkler heads. It also contains sheet libraries such as print/plot configurations, font and text style libraries, and sheet borders and title blocks. The USACE has developed Workspaces specific to USACE BIM standards; these workspaces are dependent on specific versions of the BIM applications they serve. All USACE BIM Workspaces can be downloaded from the CAD/BIM Technology Center (<https://cadbimcenter.erdcdren.mil/Default.aspx>). In some cases, there is a specific Workspace for a given CoS Facility Standard Design.
- 7.1.5. “IFC”: Industry Foundation Class, a standard and file format used for the exchange of BIM data; see [www.iai-tech.org](http://www.iai-tech.org). Note: In the context of this attachment, IFC does not mean “Issued For Construction.”

\*\*\* End of Section \*\*\*

**VOLUME II  
PART B  
VALUE ENGINEERING**

# VOLUME II

## TECHNICAL, COST ESTIMATING AND VALUE ENGINEERING REQUIREMENTS

### PART B - VALUE ENGINEERING

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## VOLUME II

### TECHNICAL, COST ESTIMATING, AND VALUE ENGINEERING REQUIREMENTS

#### PART B - VALUE ENGINEERING

1.1 **GENERAL.** Value Engineering is an organized study of functions to satisfy the user's needs with a quality product at the lowest life cycle cost through applied creativity. The intent of this section is to provide guidance on the execution of professional Value Engineering studies for the U.S. Army Corps of Engineers and ultimately present customers with improved project quality, best project value, satisfying customer needs and the reduction of project costs without the reduction of project quality.

#### 1.2 APPLICABLE PUBLICATIONS.

AR 5-4 and OCE Supplement I	Department of the Army Productivity Improvement Program (DAMPIP)
AR 672-20	Incentive Awards
DR 1180-1-1	Construction Contract Modification
EP 11-1-3	Value Engineering Officer's Operational Guide
ER 5-1-11	USACE Business Process
ER 11-1-321	Army Programs, Value Engineering
ER 37-2-10	Accounting and Reporting - Civil Works Activities
ER 37-34-5-10	Accounting and Reporting - Military Activities
FAR Part 48	Federal Army Regulations, Value Engineering
FAR Part 52.248	Federal Army Regulation, Value Engineering

1.3 **PRECONCEPT SUBMITTAL REQUIREMENTS.** VE Studies will not be performed on preconcept submittals. Any studies of project criteria will be performed by the Savannah District VE Officer (VEO).

1.4 **CONCEPT (35%) DESIGN SUBMITTAL REQUIREMENTS.** VE Studies for concept design submittals will be performed during the design review period. Results of the studies shall be received by the Savannah District at the same time that design review comments are received and coordinated. Once the VE suggestions to be adopted are approved by the User, the design A-E or the inhouse (IH) designers and Project Manager (PM) will determine if the approved items are outside the original scope for design

services. If so, a modification to the contract will be issued prior to the incorporation of the items with the final design. Start of final design will not necessarily have to wait on the processing of a modification if other nonrelated work can be started.

**1.5 SIXTY PERCENT (60%) SUBMITTAL REQUIREMENTS.** VE Studies will not be conducted on the 60% submittal unless there are unique circumstances where VE was missed at the 35% submittal and it is required.

**1.6 FINAL (100%) DESIGN SUBMITTAL REQUIREMENTS.** VE Studies will normally not be performed on final design submittals. If studies are made, they will be due to the project cost being over the budget or due to failure to perform VE Studies earlier or due to a reduction in the programmed amount during the final design phase. Remarks concerning concept design will be applicable to final design. If VE findings are small in scope, the necessary changes or additions may be incorporated during the corrected final period. If VE findings have a major impact on the design, then a contract modification to include a contract time extension will be necessary.

**1.7 CORRECTED FINAL DESIGN SUBMITTAL REQUIREMENTS.** VE Studies will normally be performed prior to the corrected final design submittal.

**1.8 VE STUDIES FOR REQUESTS FOR PROPOSAL (RFP).** VE studies will be performed on Design-Build requests for proposals prior to advertisement as scheduled by the Project Manager. VE studies for RFP packages are in essence an in-depth technical review of the entire package which includes instructions, technical criteria and often a detailed site design. The same Value Methodology shall apply to VE studies performed on Requests for Proposal and shall result in full VE Study Reports No.1 and No.2.

**1.9 VE VERSUS DESIGN.** VE encompasses a "new look" by a SECOND TEAM approach which objectively analyzes a system and its functional purpose and its interface with other systems to achieve the required function at least cost commensurate with its useful life and time frame. The prime purpose of this analysis is not to find fault or tear down the original designers, but rather to determine if the function is actually worth the cost. A comprehensive functional analysis study to identify high cost-low worth or low value items and/or entire systems is essential to the organized VE team approach. The expected cost-benefit ratio of study cost to savings is generally 1 to 30 or greater. The subject of additional design fees to incorporate VE alternatives will be considered and negotiated on a case-by-case basis.

**1.10 BEFORE THE VE METHODOLOGY CAN BE APPLIED.** Items for the building, process and production equipment, site work, site utilities, and support features of potentially "high cost and low worth" must be isolated. As part of the VE process, a cost model to identify the component costs must be prepared and included in the VE report.

**1.11 SCOPE OF WORK.** VE service shall include a VE analysis of the entire design package. The Value Engineering Study (VES) shall consist of a minimum of one 24 to 40-hour team study by a multi-discipline team of professionals. The study group will follow the five-step job plan (see paragraph 1.17) as recognized by the Society of American Value Engineers (SAVE). A VES Report No. 1 shall encompass the recommendations of the VES team with detailed "BEFORE" (as designed) and "AFTER" (VE alternative) cost estimated life-cycle cost considerations with calculations, sketches, and isometrics as necessary. A VES Report No. 2 will be a summation of those items that were accepted by the Government and which shall be incorporated into the final design package. A formal oral presentation to the design A-E or the

IH design team and to the Government will be required as delineated under paragraph 1.16 and 1.19 of these instructions.

**1.12 VALUE ENGINEERING STUDY SERVICES.** Services shall be performed in accordance with the schedules set forth in paragraph 1.19 of these instructions.

**1.13 ESTABLISHMENT AND APPROVAL OF THE VE TEAM.** VE analysis necessitates that the VE effort be performed by a separate or independent firm or group of experienced professional designers not associated with or in the regular employment in the same firm or firms performing the original design or proposals. These VE services should be performed by a qualified firm and the study must be facilitated by a Certified Value Specialist (CVS). In all situations, the team leader shall be responsible for and shall select his own team members to meet the foregoing requirements and qualifications.

**1.13.1 Members.** The VE team size shall be as required to provide VE expertise in all design disciplines included in the original design. However, in instances where a discipline has little impact on the total project cost and/or contributes an insignificant design portion of the overall project, a waiver may be granted only by the VEO. Although the VE team members shall not be the same personnel that are involved in the original design or proposal, is not to be construed or interpreted to rule out consultation and partnership between the design A-E and VE disciplines which are mandatory and vital to achieve a well-balanced and cost effective workshop.

**1.13.2 VE Experience.** All members of the team shall be completely knowledgeable of VE methodology. The VE Team Leader will be CVS certified by the Society of American Value Engineers (SAVE) International. Practical experience is considered to have been gained primarily by being actively engaged as a consultant and leader in VE activities. All members of the VES team shall have prior VE experience and training, thereby making the VE study or workshop effective and accomplished within the shortest time frame.

**1.14 VE AND A-E FIRM REQUIREMENTS.**

**1.14.1 Typical VES Team Requirements (Subcontracted VES):**

- a. Qualified Architect or Engineer/CVS
- b. Structural Engineer.
- c. Mechanical Engineer.
- d. Electrical Engineer.
- e. Civil Engineer.
- f. On a case-by-case situation, Cost Estimating/Life Cycle Analysis and Drafting technician.
- g. Obtain overview of original design from design A-E.
- h. Site visitation (on a case-by-case basis).
- i. At the termination of the VE Workshop, the VE Team Leader will make a formal presentation to the design A-E or the IH designers, the User and the Government.

j. The VE Team Formal Presentation to the Government, design A-E, User, and others will be held at the project site, unless otherwise specified. It is anticipated that a maximum of two disciplines may be required. See paragraph 1.15.2 of this guide.

k. Preparing Report No. 1, including the following mandatory enclosure:

Executive Report format with summary of initial cost savings attached. The savings must be checked off as "proposed" in Report No. 1.

l. Other Requirements for VES:

(1) The specific level of effort will be developed for the VES team based on the scope and nature of the specific project and should consider other factors such as geographical location.

(2) The PM shall coordinate the VE workshop with the VEO, the User, the IH designers, the design A-E and the VE firm as far in advance as possible. The PM shall notify all participants by phone and in writing 2 weeks or more in advance of the workshop dates to allow for adequate scheduling.

(3) The Savannah District VE Officer shall be put on "Copy to" list of review conference minutes and any correspondence relating to VE.

1.14.2 *Typical Design A-E Effort for VE Briefing and Review Response of the VE Study.* The specific level of effort for support of the VES, review of the study results, participation in the Report No. 1 presentation, and preparation of Report No. 2, which will be prepared by the VE A-E or the IH VE team, shall be based on the scope and nature of the specific project and should consider factors such as geographic location. The level of effort will be determined by negotiations.

1.14.2.1 First day of the VE Team Workshop - VE Team meets in geographical location of the design, where the designers and the user present an overview of the original design to VES team. The design team includes only design A-E or IH disciplines, ie, Project Engineer Manager, Architectural, Structural, Mechanical, Electrical, and Civil, as appropriate.

1.14.2.2 At termination of the VE Workshop or upon completion of VE Report No. 1, the VE Team Leader makes a formal presentation of VE proposals to the designers, User, and PM. The designer then joins and interacts in partnership with the VE firm by phone to supplement the VE effort in preparation for the VE Study Report No. 1 presentation. The design A-E or IH design team and the user shall review each VE change proposed by the VE Team Study and reach an agreement on acceptability. If the proposal, however, is totally unacceptable, it shall be included in the report as having been considered by the VE Team and the rejection shall be accompanied by specific technical reasons for the rejection. Upon a mutually agreeable understanding between the design A-E or the IH design team and the VE firm, the proposal may be indicated as "void" within Report No. 1 and then discussed at the oral presentation. Inasmuch as the designers may wish to include their response during the minutes covering the VE formal presentation, his response need not be in writing prior to the presentation.

1.14.2.3 The designers, VEO, PM, User and VE team shall participate in a web/teleconference for the VE Study Report No. 1 review conference where the formal oral

presentation is made by the VE Team Leader. Resolution of VE proposals and concurrence or nonconcurrence is achieved at this scheduled meeting.

1.14.2.4 At the conclusion of the VE presentation of Report No. 1, the VE A-E or the IH VE team shall prepare Report No. 2 which shall reflect the final decision of the Government's management team. Report No. 2 shall include the VE Proposal Summary Listing with summary of initial costs savings with those proposals indicated as "Accepted". The Return on Investment (ROI) is to be completed by the Government VE Officer.

## 1.15 STUDY GROUP REQUIREMENTS AND ENVIRONMENT.

1.15.1 *Information Required.* Prior to commencing a VE Study, the design A-E or the in-house design team will make available, as far in advance as possible, electronic copies of the following information to the VES Team:

- a. Full size drawings or Request for Proposals.
- b. Detailed cost estimates for full designs for parametric cost estimates for RFPs.
- c. Specifications for full designs.
- d. DD Form 1391 and PDB or other project justifications and description of project pertinent to criteria as appropriate.
- e. Basis of design.
- f. Pertinent technical requirements including technical portions of design manuals that may constrain achieving needed function at lowest overall cost consistent with desired performance.
- g. Design calculations (Mechanical, Electrical, etc.)
- h. Boring logs and soil reports.
- i. Life cycle cost calculations and energy studies based on 25-year life cycle and 10 percent annual discount rate unless otherwise directed.
- j. Other project information such as catalog cuts, photographs of the site, design and criteria manuals, etc., that will be useful to the VES team during the study period.

1.15.2 *Environment.* The VES Team shall be assembled and isolated away from their normal work station in order to avoid daily interruptions such as phone calls, quick questions, brief meetings, etc., which are very disruptive. If circumstances require it, an appropriate meeting room, motel room, etc., should be rented for the workshop to provide the following:

- a. Room size to accommodate all VE study participants and preferably isolated from normal environment.
- b. Adequate lighting for prolonged reading, writing, etc.
- c. Tables large enough to accommodate full size drawings and chairs for all VE study participants.

- d. Proximity and access to telephones and duplicating machines.
- e. Blackboard and/or flip chart.
- f. Projectors and screens.
- g. Current estimating books, at least three-holed punch, scissors, scales, tracing paper, multi-color felt tip pens, loose-leaf notebooks, etc.

**1.16 BASIC REQUIREMENTS FOR VE.** VE studies shall be accomplished using a functional analysis approach. It should be noted that cost reduction actions cannot be labelled "Value Engineering" unless the action includes identifying the function, brainstorming and selecting the alternative that will perform the required function at the lowest total cost considering performance, reliability, quality, and maintainability. The six-phase VE Job Plan shall be used and is as follows:

- a. Information. For information gathering and identification of high cost - low worth functions. Define and analyze design, evaluate function, and establish worth. Note: Original design team is required to present the VE Team with an overview of original current design. The design team, VE Team and PM shall attend.
- b. Function Analysis Phase. This is a critical step in the VE Job Plan and is what differentiates VE when comparing it with other review processes. It also serves as a team building exercise that should not be truncated. Considerations include, but are not limited to:
  - Ensure that the activity is meaningful and enhances the team's understanding of the project
  - Ensure that functions are defined as 'verb/noun' and are not project activities
  - Identify project features/activities with defined functions
  - Assess high-cost features with their corresponding functions for study focus
  - Have the team develop a Function Analysis System Technique (FAST) Diagram or other appropriate function model.
- c. Creative (Speculative) Phase. For brainstorming the generation of alternative ideas by means of creative thinking atmosphere and the withholding of judgment during this phase. The design team, VE Team and PM shall attend.
- d. Evaluation (Judgment/Judicial) Phase. For evaluating and judging each alternative idea for merit and separating needs from desires. List basic advantages/disadvantages, compare, evaluate, refine, and select best alternative ideas for development of firm proposals. The design team, VE Team and PM shall attend.
- e. Development Phase. Fully develop and summarize best alternative ideas using accurate and realistic costs. Develop "before" and "after" cost comparisons with net savings. Discard alternatives that prove to be not cost effective or of low value. Only the VE team shall attend.
- f. Presentation Phase. Prepare a formal presentation report in sufficient detail for the fully developed viable alternatives including view-graphs, savings, and

recommendations needed to implement each specific VE proposal. The report must be in sufficient detail to permit a technical review to evaluate the merits of each proposal. The design team, VEO or VE Team Leader, User and PM shall attend.

**1.17 REPORTS AND MINIMUM DOCUMENTATION REQUIREMENTS FOR VE.** The results of each VE Study performed on the project shall be documented as follows:

a. Reports and Minimum Documentation in final 8-1/2 x 11 format for both Study Report No. 1 and Study Report No. 2:

(1) Executive Report and contents page with summary of initial cost savings for both Report No. 1 and Summary Report No. 2.

(2) VE Study proposal summary listing with summary of initial cost savings. ROI to be completed by the Government VE Officer. Serves as a "Record of Decisions" and is mandatory for Report No. 2.

(3) Brief description of total project to include a site plan and current Project Amounts (PA).

(4) Brief summary of VE recommendations including initial and life cycle cost savings (provide "use" experience where material alternates are recommended).

(5) Each VE proposal will be described "Before and After VE" listing advantages and disadvantages. Sketches and isometrics will be provided as necessary to clearly depict VE proposals. Footnote new material and recommendations to change criteria.

(6) Each proposal will be accompanied with a detailed realistic cost estimate of savings. Life cycle cost analysis for energy proposals and other proposals, as appropriate, all in accordance with acceptable guidance

(7) Value Engineering Comments other than specific proposals will be included after last proposal.

(8) Appendices to include Contact Directory, Creativity List, VE cost model(s) of project plus bar graphs of subsystems, Functional Analysis Systems Technique (FAST) Diagram, DD Form 1391 and any other supporting documentation.

b. VE Report No. 1. This preliminary report shall be prepared by the VE Study Team and shall document the "VE Job Plan" and the results of the Value Engineering Study and services performed. The VE Team shall not be limited by the technical requirements and the design data, but shall challenge it except for the construction cost limitation which shall not be exceeded. Savings generated by criteria challenges and/or waivers to criteria shall be footnoted. All proposals and their respective original and proposed detailed estimates shall be documented in this report. Where clarification is deemed appropriate, the proposal shall be supported by rough-hand sketches, isometrics, drawings, descriptions, interface systems, specifications, and life-cycle cost to permit a thorough evaluation by the design A-E, the IH design team, VEO, PM and User. The report shall be concise, yet informative in all respects. If the VE study results in no recommended changes to the design, a detailed report indicating the effort and areas considered shall be submitted.



c. The Second and Final Report No. 2. This report will be prepared by the VES team and is a summation of those items that were accepted by the design A-E, the IH design team, VEO, PM and User. Report No. 2 shall be complete and final in all respects with all proposals resolved unless specifically reserved by the Government. Accordingly, Report No. 2 shall not list any items "Held in Abeyance" unless so directed. Description and summation of proposals shall include initial and life cycle savings for all proposals. Minutes of VE presentations shall be the responsibility of the Project Manager. A copy of the minutes shall be included in Report No. 2. The accepted proposals enumerated in Report No. 2 shall constitute a "Record of Decisions" on VE recommendations to be implemented if so directed by a separate order. Also, certain proposals that have been accepted in past VE studies will be accepted in future projects unless ruled otherwise by the Government.

**1.18 VE REPORT FORMAT.** Report No. 1 and Summary Report No. 2 (and other reports that may be called for in the scope of work) must be systematically assembled and must be short and concise, yet informative. VE reports shall be prepared and submitted for final reproduction on 8-1/2 x 11 paper. Pages must be sequentially numbered in the lower right-hand corner to facilitate assembly. Report No. 1 shall be referenced by Report No. 2. The reports shall be computer generated in accordance with the latest guidance.

**1.18.1 Numbering System.** If responding is necessary, the design A-E or the IH design team shall refer to the VE report using the same numbering system as in the VE report and in the same sequence as in the report submitted by the VE team. This will facilitate an orderly final review by all concerned parties.

**1.18.2 Alternatives.** All alternatives which are unacceptable to the design A-E, the IH design team, the User and the reviewers must be supported by reason for rejection, including technical, cost, codes, etc. All of the designers' calculations, both cost and technical calculations, should be included in an appendix. Also, all alternatives presented in the VE report, identified as Other Areas of Potential Savings, must be responded to in the same manner. Where possible, savings associated with these other areas should be included even though the savings are not shown by the VE Team in the VE Study.

**1.19 VE REPORT SUBMISSION SCHEDULES FOR ORAL PRESENTATION.** VE studies shall be submitted in accordance with the schedules as set forth in the Project Management Plan (PMP) and required number of submittals set forth at the predesign or prestudy conference.

**1.19.1 Working Relationships.** Copies of Report No. 1 shall be sent out (either electronically or hard copies) in time to be received and reviewed by the Government at least 2 weeks prior to the formal VE oral presentation. Report No. 1 shall receive concurrent review by the design A-E or the IH design team and the Government to include the Using Agency. The design A-E or the IH design team shall consult with the VES Team as necessary during the review time to identify problem areas or questionable VE proposals. It is envisioned that with a good harmonious relationship and the proper spirit of cooperation prior to the formal oral VE presentation to the Government, differences will have been resolved and agreement and concurrence will have been reached between the design A-E or the IH design team and the VE team regarding acceptable cost effective VE proposals or alternative proposals. Accordingly, the Government will have to rule only on those proposals involving criteria changes and those few proposals where agreement is in doubt.

1.19.2 *Presentation and Report.* In all cases, the VE Team will be required to make a formal oral VE presentation (using aids such as lap top computers with projectors, flip-charts, sketches, isometrics, or other acceptable methods) to the Government, the design A-E, and the User within a 2-week period (unless indicated otherwise) immediately following the submittal of VE Report No. 1. Prime A-E representatives shall attend the VE presentation unless otherwise scheduled. Copies of VE Report No. 2 will be prepared by the VES team and submitted following the oral presentation to the Government. It is particularly important that other cost effective suggestions that may evolve from attendees during the VE presentation to the Government be incorporated by the VES team in the VE Report No. 2.

1.20 **APPROVAL AND IMPLEMENTATION OF PROPOSED VE CHANGES.** The Contracting Officer may approve or reject in whole or in part any VE change and reasons for rejection shall be included in the minutes of the formal VE presentation and Report No. 2. The implementation of approved VE changes shall be the incorporation of the approved changes into the final design of the project only as directed by the PM and the Contracting Officer under the changes clause of the contract.

1.21 **SPECIFIC INSTRUCTIONS.** The VE proposals and ideas become the property of the Government and may be used on future contracts or designs without additional compensation to the A-E.

# **APPENDIX**

**Reference Format for complete Value Engineering  
Study Report**

**Contact the District Value Engineering Officer (VEO)  
for the current working electronic format of this  
document**

DOD SERVICE:USACE  
CONTROL NO:  
VALUE ENGINEERING OFFICER:

Value Engineering Study on the

**TITLE**

**SUB-TITLE**

**LOCATION**

DATE

U.S. Army Engineer District, \_\_\_\_\_

**VALUE ENGINEERING FIRM NAME:**

ADDRESS: 100 W. Oglethorpe Ave  
Savannah, Georgia 31401  
PHONE: (912) 652-XXXX

**VALUE ENGINEERING STUDY TEAM LEADER:** \_\_\_\_\_

**VALUE ENGINEERING STUDY TEAM MEMBERS**

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VALUE ENGINEERING TEAM STUDY  
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VALUE ENGINEERING TEAM STUDY  
PROJECT DESCRIPTION AND BACKGROUND

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PROJECT TITLE:  
PROJECT LOCATION:

---

**Include location Map**

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VALUE ENGINEERING TEAM STUDY  
EXECUTIVE SUMMARY

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Value Engineering is a process used to study the functions a project is to provide. As a result, it takes a critical look at how these functions are met and develops alternative ways to achieve the same function while increasing the value of the project. In the end, it is hoped that the project will realize a reduction in cost, but adding value over reducing cost is the focus of VE.

The Value Engineering Study was initiated during the VE workshop/conference conducted in the \_\_\_\_\_ during \_\_\_\_\_. The study was based on the District \_\_\_\_\_, dated \_\_\_\_\_, dated \_\_\_\_\_. A site tour was conducted with \_\_\_\_\_ and VE Team Members on \_\_\_\_\_.

The project was studied using the Corps of Engineers standard Value Engineering (VE) methodology, consisting of five phases:

Information Phase: The Team studied drawings, figures, descriptions of project work, and cost estimates to fully understand the work to be performed and the functions to be achieved. Cost Models (see Appendix C) were compared to determine areas of relative high cost to ensure that the team focused on those parts of the project which offered the most potential for cost savings.

Function Analysis Phase. This is a critical step in the VE Job Plan and is what differentiates VE when comparing it with other review processes. It also serves as a team building exercise that should not be truncated. Considerations include, but are not limited to:

- Ensure that the activity is meaningful and enhances the team's understanding of the project
- Ensure that functions are defined as 'verb/noun' and are not project activities
- Identify project features/activities with defined functions
- Assess high-cost features with their corresponding functions for study focus
- Have the team develop a Function Analysis System Technique (FAST) Diagram or other appropriate function model.

Creative Phase: The Team speculated by conducting brainstorming sessions to generate ideas for alternative designs. All team members contributed ideas and critical analysis of the ideas was discouraged (see Appendix B).

Evaluation Phase: Evaluation, testing and critical analysis of all ideas generated during speculation was performed to determine potential for savings and possibilities for risk. Ideas were ranked by priority for development. Ideas which did not survive critical analysis were deleted.

Development Phase: The priority ideas were developed into written proposals by VE team members during an intensive technical development session. Proposal descriptions, along with sketches, technical support documentation, and cost estimates were prepared to support implementation of ideas. Additional VE Team Comments were included for items of interest which were not developed as proposals, and these comments follow the study proposals.

Presentation Phase: Presentation is a two-step process. First, the published VE Study Report is distributed for review by project supporters and decision makers. The formal, oral presentation of the VE Study Proposals will be coordinated through the District on \_\_\_\_\_.

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VALUE ENGINEERING TEAM STUDY  
SUMMARY OF PROPOSALS

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\_\_\_ ideas for ways to improve the project or reduce costs were generated during the Speculation Phase of this study. The Analysis Phase of the study reduced the number of ideas to \_\_\_ for development of which \_\_\_ ideas were designated as design comments and are included in this report.

Of all the ideas from the Analysis and Development Phases, \_\_\_ ideas became proposals which, when accepted, can result in maximum possible cumulative savings of \$\_\_\_\_\_ for this \$\_\_\_ project.





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PROPOSAL NO:  
DESCRIPTION:

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PAGE NO: 1 OF 4

ORIGINAL DESIGN:

PROPOSED DESIGN:

ADVANTAGES:

- 1.
- 2.
- 3.

DISADVANTAGES:

.

JUSTIFICATION:

VALUE ENGINEERING PROPOSAL

PROPOSAL NO:

PAGE NO: 2 OF 4

DRAWING NO. 1

Existing Condition

VALUE ENGINEERING PROPOSAL

PROPOSAL NO:

PAGE NO: 3 OF 4

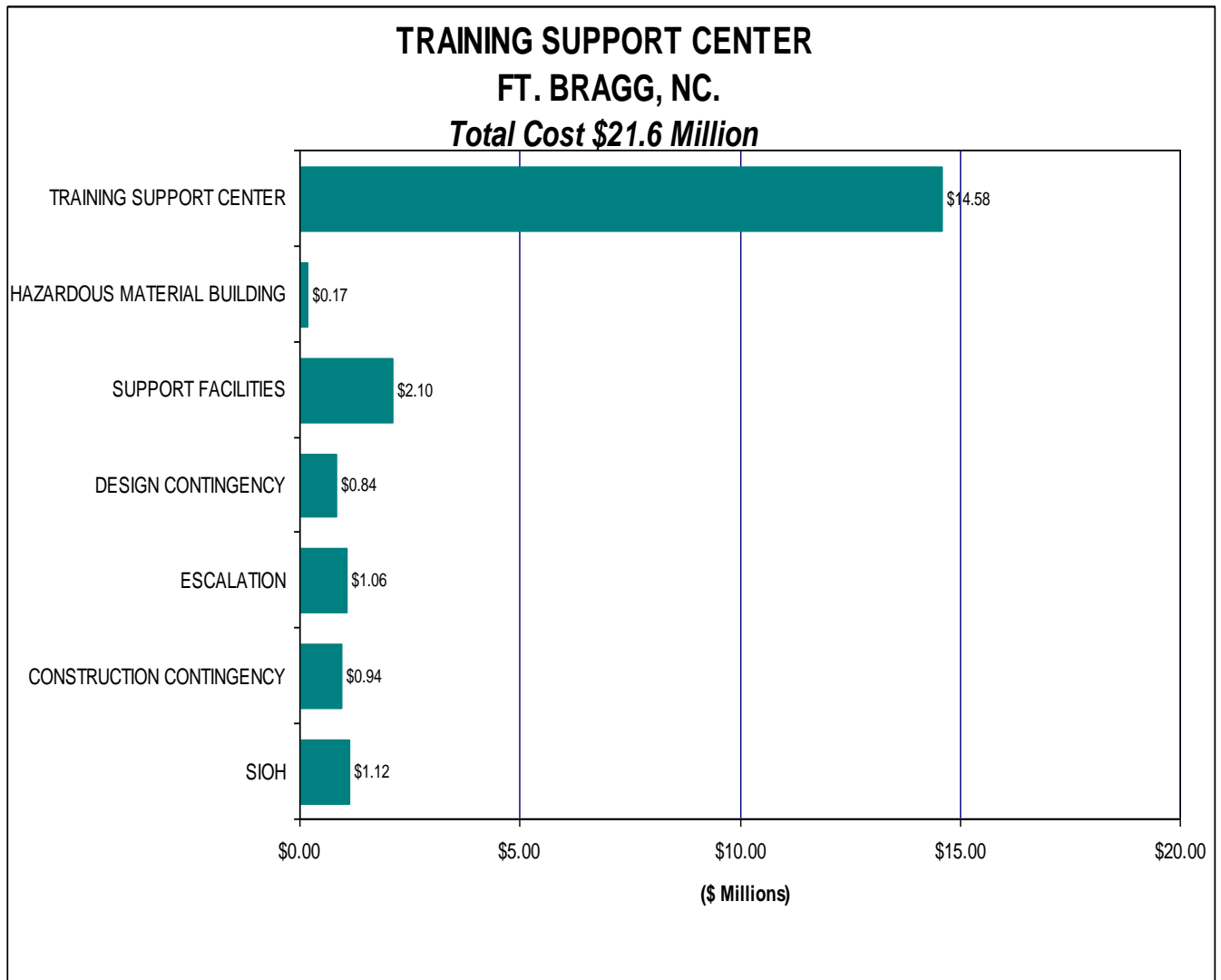
DRAWING NO. 2

Proposed Condition



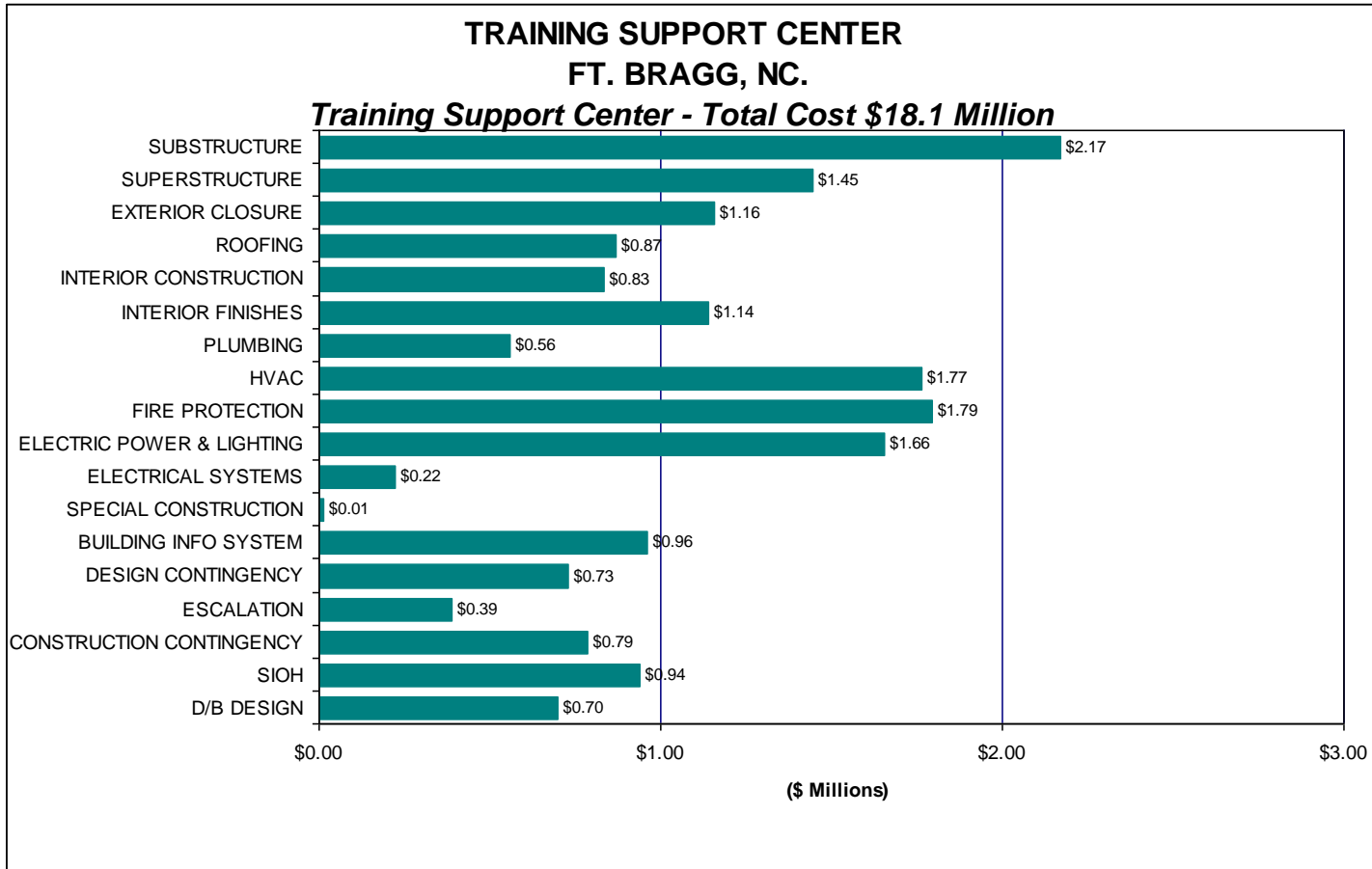






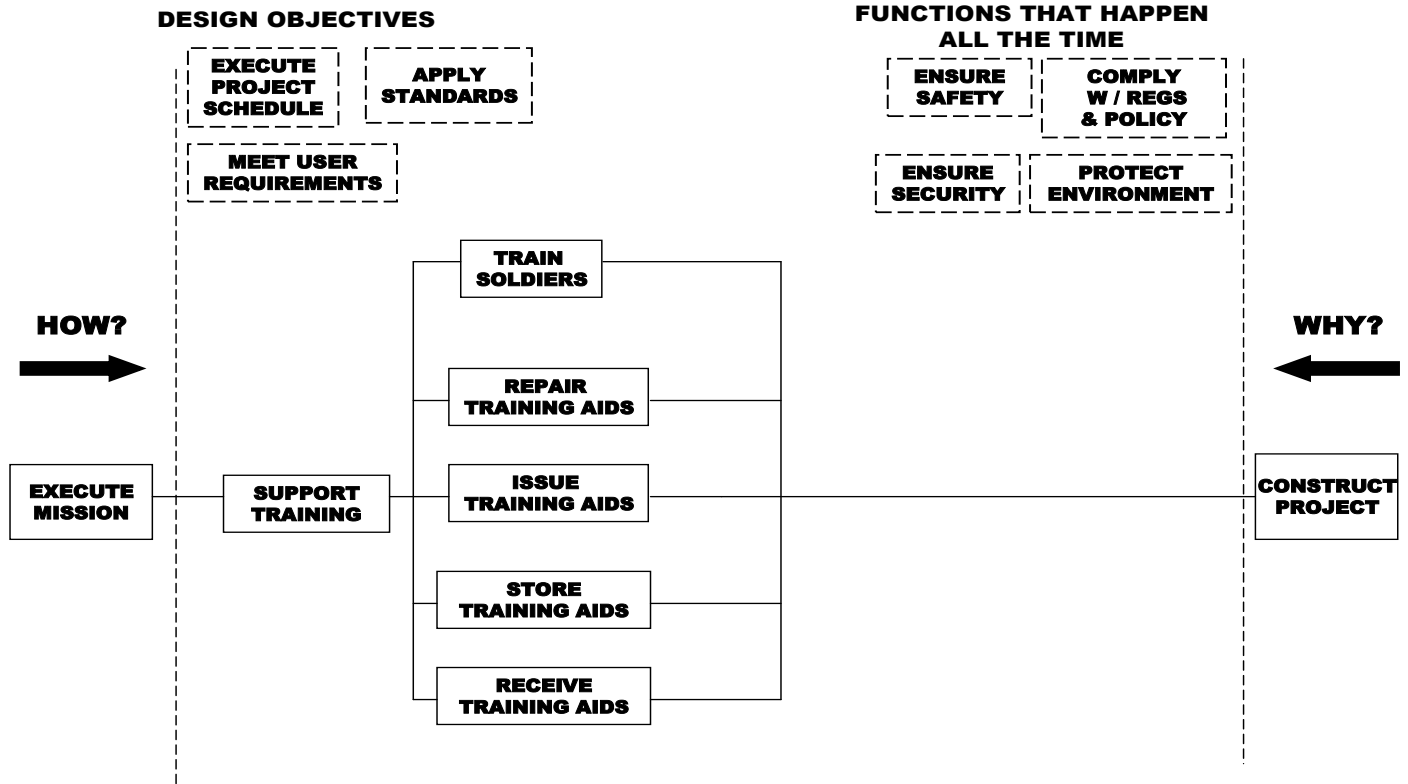


**APPENDIX C: COST MODEL**



VALUE ENGINEERING TEAM STUDY  
**APPENDIX D: FAST DIAGRAM**

**TRAINING SUPPORT CENTER, FT. BRAGG, N.C.**



**FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM**

\*\*\* End of Section \*\*\*